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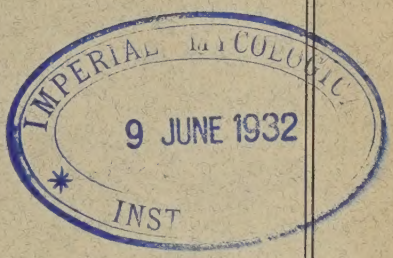
EMPIRE COTTON GROWING CORPORATION.



REPORT OF THE ADMINISTRATIVE COUNCIL OF THE CORPORATION SUBMITTED TO THE ELEVENTH ANNUAL GENERAL MEETING ON MAY 26th, 1932.

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EMPIRE COTTON GROWING CORPORATION.

Annual Report

FOR THE SEASON

1930-1931.

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EMPIRE COTTON GROWING CORPORATION.

REPORT OF THE ADMINISTRATIVE COUNCIL OF THE CORPORATION SUBMITTED AT THE ELEVENTH ANNUAL GENERAL MEETING, ON MAY 26TH, 1932.

The work of the Corporation during the last year has been difficult, and it has had its full share of the trouble with which the world is beset. Reduction of general purchasing power, currency dislocation, and a steady augmentation of the deadly toll that politics continue to take of economics have all been contributing causes to the commodity slump which has confounded every reasonable calculation.

A modification of English economic policy and a gigantic American crop have all made the task of anticipation difficult, while world political conditions constitute further incalculable elements. The riddle of Russia's economic development still remains to be read, and no unanimity exists among the voices of the augurs that attempt to forecast the future. At the risk of joining the ranks of discredited prophets, it appears likely that the organic connection of part of the world on

the basis of sterling appears on the whole likely to become intensified, and if that be conceded, parts of the problem appertaining to Empire cotton-growing are slightly simplified.

At all events it remains as true as ever that for Lancashire again to drift into dependence on countries whose economic problems differ fundamentally from our own would be the height of unwisdom, however clouded in other directions the horizon may at times appear. It now remains to give in detail some account of the work of the Corporation. Technical difficulties and setbacks have not been absent in all parts of Africa, but the outlook in the Anglo-Egyptian Sudan is definitely brighter than it was a year ago, due partly to more normal climatic conditions, and partly to the ability and determination with which difficulties have been faced by all nterested, both on the scientific and administrative sides.

The Report comprises a general review of the position and prospects of cotton in each of the principal countries of the Empire in which the crop is grown. A more detailed account of some of the Corporation's own activities is supplied by the publication, which appears annually in February, entitled " Reports received from Experiment Stations." The contents of that volume are necessarily somewhat technical, but a preface is included in which an attempt is made to describe in non-technical language the chief lines upon which the staffs of the several Experiment Stations are working and to summarize the progress that has been made. It will be found that the work of the Stations has two main objectives, namely, improvement in the quality of the cotton grown, and an increase in the yield per acre. Closely linked with the improvement in the quality are the examination of samples by brokers and the spinning tests carried out on them at the Shirley Institute, for the factors on which the buyer bases his judgment of quality, and the spinning value of the samples submitted

are naturally of the greatest importance to the agriculturist and to the plant breeder who are trying to develop in the crop those qualities that render it valuable.

That so much attention is also being given to obtaining higher yields may at first seem somewhat of a paradox in face of the figures published in March, which pointed to the probability that the world supplies of cotton at the end of this season would exceed a whole season's consumption. It may therefore be desirable to clear up any possible misapprehension on this score as to the value of this side of the Corporation's work in the existing economic circumstances. Over-production of any commodity is inevitably followed by a reduction in the total output, and that reduction will naturally be effected by cutting out first the areas on which the losses have been heaviest. The higher the yield of cotton per acre, the lower will be the cost of production per pound, and thus a high-yielding area naturally has the better chance of survival in competition, when over-production dictates a reduction in acreage. For this reason, therefore, the Corporation's staff is constantly trying to improve the efficiency of the areas in which they are working, whether the lines of attack are by breeding more prolific varieties or by attempting to find methods of control for the numerous insect pests and diseases which in all countries take so heavy a toll of the crop.

Personnel.

At the time when the last Annual Report had to be drafted the appointments to the new Council nominated in 1931 were still incomplete. Although all nominations were in fact received before the last General Meeting of the Corporation, the changes in the personnel of the Council made last year are set out here for the sake of completeness of the records.

The Federation of Master Cotton Spinners' Associations nominated Mr. H. Dunkerley in place of Mr. O. Mallalieu ; the Cotton Spinners' and Manufacturers' Association nominated Mr. J. Astley-Birtwistle in place of Mr. F. A. Hargreaves, and the Amalgamated Society of Beamers, Twisters and Drawers are represented by Mr. J. Stott in succession to the late Mr. W. C. Robinson, the news of whose death was received with great regret. The London Chamber of Commerce nominated Lieut.-Colonel C. E. Ponsonby in place of the late Sir Edmund Bartley-Denniss, and the representatives of the Bombay and Ahmedabad Millowners' Associations are now respectively Mr. R. P. Scott and Mr. R. J. Udani.

Shortly after the Annual Meeting, the Foreign Office nominated Mr. M. D. Peterson as their representative in place of Mr. John Murray, who had been appointed Counsellor to the Embassy at Rome. The Colonial Office have nominated Mr. J. G. Hibbert to succeed Mr. G. H. Creasy as Sir Cecil Bottomley's deputy on the Council and Executive Committee of the Corporation.

Mr. Percy Ashley ceased to be an officer of the Board of Trade on his appointment as Secretary to the Import Duties Advisory Committee, and the Board have appointed Mr. L. Browett, C.B.E., to succeed him on the Corporation's Executive Committee and Administrative Council.

The Corporation welcome this opportunity of recording their indebtedness to Mr. Ashley and their warm appreciation of the great interest he has always taken in their work. His advice and assistance have been readily placed at their disposal ever since the establishment of the Corporation, during which time he has been the Board of Trade's representative on the Corporation. But, in addition, before the Charter was granted, he was constantly consulted by the Empire Cotton Growing

Committee of the Board of Trade, and the success that attended the negotiations that led to the formation of the Corporation was in large measure due to Mr. Ashley's help and encouragement.

At their meeting in January last, the Council decided to invite Mr. Hamilton Kerr, M.P., to accept co-option as a member of Council, and the invitation has been accepted. Members will be sorry to learn that Mr. J. Crinion has found it necessary to resign his membership of the Council owing to ill-health. The Federation of Master Cotton Spinners' Associations have recently nominated Mr. F. Mills in place of Mr. J. Wild. The above changes will be reported officially at the meeting at which this Report is presented.

During the past year, the Corporation have had to congratulate two of their Vice-Presidents: the Rt. Hon. Walter Runciman, M.P. and the Rt. Hon. W. G. Ormsby-Gore, M.P., on their appointment as Cabinet Ministers. It is also with the greatest gratification that they noted in the New Year's Honours List that their Chairman, Sir Richard Jackson, had been awarded a Knighthood. The Corporation also offer their congratulations to Lord Stanley, M.P., a member of the Administrative Council, on his appointment as Parliamentary Secretary to the Admiralty.

India.

The year 1931 opened inauspiciously for cotton as for other Indian primary commodities. No. 1 Fine Oomra was quoted at as low a figure as 3·70d. per lb., in January of that year, though the highest quotation for the month was 4·49d. This was followed by a slight improvement in February and March when the prices ranged from 4·57d. to 4·22d. Prices

continued to decline slowly but steadily up to September when the lowest price—2·26d. per lb.—was reached. Towards the end of that month, Great Britain abandoned the Gold Standard, an event followed by a general rise in the sterling prices of primary commodities. In October, the highest quotation for Oomra was 4·45d. per lb., and by December this had increased to 5·03d. This tendency was maintained throughout the first two months of 1932, the highest quotation in February being 5·67d. per lb.

The prevailing economic depression which was a feature of world conditions in 1930, continued in 1931 and is fully reflected in the serious decline in India's exports of raw cotton from 2,614,925 bales (of 400 lbs.) in the nine months April to December, 1930 to 1,883,095 bales in the corresponding period of 1931. The decline in value was even more serious, from £24,000,000 to less than £14,000,000. The corresponding figure for 1929 was £32,000,000 ; the fall in the value of the trade since that year has thus amounted to 56 per cent. Although this decline is mainly attributable to the fall in world prices and the comparatively low demand for primary products, the decline in the volume of exports is in part accounted for by a greater demand in India itself for raw cotton on account of the growing demands of the local industry. Thus the Indian mills imported during the nine months April to December, 1931, 312,032 bales of raw cotton as against 112,341 bales and 185,584 bales in the corresponding periods of 1929 and 1930. During 1931, imports of American cotton amounted to 197,977 bales, of East African cotton to 157,192 bales, and of Egyptian to 51,027 bales.

The table below indicates the extent to which the principal countries importing raw cotton from India have reduced their purchases in 1931 as compared with 1930. It will be observed that although every country has bought less, the biggest

percentage fall occurs in the case of France. With regard to China, it should be remembered that her imports of cotton from India in 1930 were comparatively high :—

EXPORTS OF RAW COTTON FROM INDIA TO PRINCIPAL DESTINATIONS.

Country.	April-Dec., 1930.	April-Dec., 1931.	Decline.
	Bales.	Bales.	
U.K.	174,042	133,694	40,348
Germany	231,263	133,325	97,938
Belgium	158,390	97,076	61,314
France	157,410	69,630	87,780
Spain	85,713	37,581	48,132
Italy	260,680	162,041	98,639
China	451,141	394,133	57,008
Japan	999,549	772,240	227,309
U.S.A.	32,464	23,878	8,586

The principal cotton-growing areas in India lie in the Bombay and Madras Presidencies and in the provinces of the Punjab, the United Provinces and the Central Provinces. In these areas research work on cotton has been pressed forward with a view to the establishment of the most suitable types. Work in the laboratory is followed up by demonstrations and propaganda in the field, and the result is a gratifying and steady increase in the areas under improved types each year as the following table will show :—

	1927–28. Acres.	*1928–29.	Increase.
Punjab	1,132,830	1,524,470	+ 391,640
Bombay	996,173	1,036,873	+ 40,700
Central Provinces	469,144	627,671	+ 158,527
Madras	315,348	425,468	+ 110,120
United Provinces...	210,000	215,000	+ 5,000
Total ...	3,123,495	3,829,482	+ 705,987

* No later statistics have been published at the time of going to press.

The formal opening of the Sukkur Barrage in Sindh early this year by His Excellency the Viceroy of India, marking as it did the completion of the greatest irrigation project in the world, will stand out as a landmark in the agricultural history of India. A large area of land which previously depended for its irrigation on the natural level of the Indus River, and another large area which in the past did not receive any irrigation at all, but depended for its cultivation on the very scanty and precarious rainfall in Sindh, will now be assured of constant supplies. Investigations into the nature of the soil and the types of cotton yielding the highest returns and responding best to local conditions of soil and climate have been in progress simultaneously with the construction of the barrage and the canals, and it is certain that this area will make an important contribution to the total production of cotton in India. A full programme of research work on cotton is now in progress at the Research Station at Sakrand, and the possibilities of growing American and Egyptian strains are being investigated. Work on Sindh " Deshi " cotton, which has greater powers of resistance to the local climate and is at the same time capable of much economic improvement, is also in progress. Valuation reports and spinning tests of the cottons now under test at Sakrand show that many of them are capable of commanding a premium over Broach and of spinning counts from 34's to 80's. With the object of extending the improved varieties of cotton in the Barrage area, a cotton supervisor with a suitable subordinate staff has been appointed for the Barrage tracts on each bank of the river in accordance with a scheme which is being financed for three years by the Indian Central Cotton Committee. Another interesting suggestion which is receiving the close attention of the local administration is that of licensing gins and press-houses in the Barrage zone with a view to avoid the evils of mixing. In order to achieve some measure of co-operation between the

cotton growers and the merchants, an advisory body, on which both producers' and merchants' interests will be fully represented, has been established, and it is anticipated that this body will be able to render most useful assistance in dealing with cotton-growing and marketing problems in the Barrage area.

The final all-India cotton forecast for 1931–32 shows a total cultivated area of 23,522,000 acres with a yield of 4,046,000 bales (of 400 lbs.) as compared with 23,500,000 acres and 5,110,000 bales last year. One result of this short crop has been a closer approximation of the prices of East Indian to those of American cotton.

Australia.

The Cotton Specialist to the Queensland Government describes the season 1930–31 as showing substantial progress in the development of the cotton-growing industry. The acreage from which cotton was picked was considerably greater than had been anticipated. This was largely due to the abnormally late mild weather which allowed cotton to mature on land which had in some cases been planted as late as mid-January. In spite of unfavourable early and mid-seasonal conditions, the yields generally were good. The multiplication of strains selected at the Research Station was particularly gratifying : one grower with 66 acres averaged 1,499 lbs. seed cotton per acre, while another with 38 acres averaged 2,100 lbs. per acre. The position as regards seed stocks is therefore most satisfactory, and enough seed should be obtained at the end of the present season to plant the whole of the Central and Northern areas.

The Research Station at Biloela was unfortunately one of the driest spots in the cotton-growing area. No planting rains fell until mid-January, and no good rains until the end of that

month. Subsequently, conditions were favourable, but a late and severe attack of corn-ear worm destroyed all hope of obtaining good yields from the experimental plots; the attack was, in fact, so severe that no picking was made. In spite of the adverse conditions, the behaviour of the plants confirmed the conclusion previously reached that early planted cotton gives the best chance of getting good yields, provided that succeeding rains allow it to function as early cotton.

Co-operation between the Station at Biloela and the Corporation's Research Station at Trinidad continues. Mr. Wells, the Queensland Cotton Specialist, is in correspondence as regards certain physiological problems with Dr. Mason, Head of the Physiology Department at the Corporation's Station, while he has also sent several samples of the different types of soil on which cotton is grown in Queensland to Professor Hardy, of the Imperial College of Tropical Agriculture, who has kindly offered to have them analysed.

Increased interest is undoubtedly being taken in cotton-growing in Queensland. To some extent this is no doubt due to the low prices obtainable for maize, pigs and dairy produce, but the high yields obtained last season, both from the seed multiplication areas and the variety tests, have also had their effect. Mr. Wells considers that the farmers now understand much better the relative suitability for cotton of the different types of soil: moreover, whereas formerly the maize and fodder crops received attention first, and then, if the season were favourable and the farmers had time, they planted some cotton, the position is now reversed. Under the conditions existing in Queensland, cotton is recognised to be the best paying crop, and the price is guaranteed; it now receives first attention in consequence.

The crop receives a bounty from the Commonwealth Government, and is all consumed by Australian mills.

The results of last season and the position with regard to other crops and agricultural commodities have led both to an increase in the number of growers, and to former growers increasing their seed demands. It is believed that the seed issued for the season 1931–32 was sufficient to plant 65,000 acres.

Writing in February last, the Cotton Specialist reported that the conditions for the season 1931–32 had not been very satisfactory. The spring temperatures had been too cool, and the planting rains, with the exception of one small district, somewhat late or very late. Heavy rainfall at thinning time had greatly delayed operations and increased costs of cultivation. Although some abandonment of acreage had occurred, the greater part of the crops were brought through in good condition until an unbroken spell of several weeks of dry and very hot weather followed the heavy rains of December. These conditions continued without a break for several weeks and caused general shedding of the entire top and middle crops in large parts of the cotton-growing districts. In several areas it was feared that the crop would be a complete failure. A forecast at that period of the season was very difficult, but it was thought unlikely that the crop could exceed 11,000 bales of 400 lbs.

At the Experiment Station varietal trials are being carried out on a fairly large scale to meet the popular demand for a shorter stapled cotton. The fact that the season was a late one will test the ability of new varieties to mature their crop rapidly.

South Africa.

Owing to the fall in prices at the close of the previous season, it is estimated that the acreage planted in 1930–31 showed a reduction of approximately 30 per cent. Moreover, the climatic conditions for cotton-growing were the most

difficult experienced in recent seasons. The planting rains were extremely late, in fact, in some parts no cotton could be planted until late December ; the growing season was characterised in practically all districts by a rainfall well under the average, and in some parts of the country there was a drought. It was clear from the outset that cotton planted so late could only succeed if the growing season were prolonged, but this hope was destroyed by the lack of rain, and in the Low Veld by the fact that the frosts were more extensive than usual, thus bringing the season there to an early close. Bollworm was a serious pest in most of the cotton-growing parts of the country, doing extensive damage, particularly to plant cotton on dry land. As a result of these unfavourable conditions there was a considerable reduction in the crop, which reached a total of less than 9,000 bales of 400 lbs., as compared with over 16,000 bales in the previous year.

The Corporation's work at the Experiment Stations in the Union and in Swaziland was naturally hampered by these conditions, but some useful results were obtained, particularly in the work on insect control.

As regards the Cotton Breeding Station at Barberton, while it is obviously appropriate to refer to its work in this section of the report which deals with South Africa, it is desirable again to emphasise that the plant breeding and other work of that Station has a significance which is far from being purely local, and its results are being successfully applied or adapted in many of the cotton-growing countries of Africa, notably in Rhodesia, Nyasaland and Tanganyika. One factor which influenced the Corporation in their decision to make the Barberton Station their principal centre for experimental work of this type, was that such work can be carried on there under conditions which are considerably more healthy for Europeans than those which would normally have been found if a site for

the Station had been chosen in some other parts of Africa, where the commercial crops of cotton are larger, and where the experimental results obtained might therefore have found wider application in the immediate neighbourhood. The importance attached by the Corporation to the value of the work at Barberton is indicated by the fact that steps have been taken during the past year to increase the staff by the addition of another entomologist and three junior agricultural officers. This additional staff was necessitated not only by the increasing amount of work to be undertaken, but by the necessity for ensuring during leave periods the continuity of the experimental work at all the three experiment stations maintained by the Corporation in South Africa and Swaziland.

In his summary of the work carried out in the Low Veld last season, Mr. Milligan states that the cotton area there is now all under the variety U.4, and, since the introduction of this strain, jassid damage has been almost negligible. This variety also possesses the two valuable properties of making a rapid recovery after drought and after bollworm. The fact that it is usually capable of producing a good crop after the bollworm attack has passed off, provided that the soil moisture is adequate, is a specially important character.

Last season, Barberton suffered severely from stainer, which has hitherto done but little damage there, and this fact rendered re-selection work on U.4 particularly difficult in consequence.

Work on methods of insect control was continued, but it is too early yet to be able to assess definitely the value of the results obtained in course of the investigation on the possibility of biological control by means of parasites. The addition of another entomologist to the staff has rendered it possible for attention to be devoted to cotton stainers, which are probably the most widely distributed of all cotton pests throughout

Africa, and which constitute a limiting factor to the growing of the crop over large areas.

In view of the importance of obtaining suitable rotation crops for cotton, more work on these is now being done, the additions to the staff having rendered it possible for this problem to receive more attention. The main crops grown are maize, sunflowers, groundnuts, and a range of beans. Samples of beans and of groundnuts have been sent home for analysis and market reports, and the Corporation are much indebted to the authorities of the Imperial Institute who have been good enough to arrange for this work to be carried out. The analyses and reports thus furnished have proved extremely useful to the officers in charge of this work, but the low prices ruling for all agricultural produce make it difficult at present to gauge the relative values of the different crops.

Last year, Mr. Parnell, who had been in charge of the Barberton Station for seven years continuously, came home on leave, and it is gratifying to record that the farmers of the district took advantage of the occasion to make him a presentation as a mark of their appreciation of his work for the cotton-growing industry in the Low Veld and in Swaziland by the production of a jassid-resistant variety.

A considerable proportion of the South African cotton crop is produced under irrigation on the Lower Orange River, where the crop amounted to nearly 3,000 bales in 1930–31. An interesting report on this district has been received from Mr. Gutsche, formerly a holder of one of the Corporation's Studentships, who is in charge of the Experiment Station for this part. The growers, there as elsewhere, have been discouraged by the slump in prices, and the area under cotton has been much reduced this season in consequence; nevertheless the return from cotton still compares favourably with that obtainable from other crops that could be grown. At the

Experiment Station different varieties are being compared and trials carried out on the best spacing, time of planting, the number of irrigations, and the value of various types of fertilizers.

As regards the present season, Mr. Parnell reported in February that the prospects in the Barberton area were definitely poor, since the area planted was small and much of the crop was very backward. The reduction in area was due largely to the low price of cotton, aggravated by losses on Exchange, which makes the crop unremunerative for anything but exceptionally good yields. The majority of farmers planted much less than usual, some none at all, pending some indication of a rise in prices. Still further reduction was caused by the lack of good planting rains in the spring.

The season had been very dry throughout and the whole crop had suffered continually. It had been kept alive by light showers, but there had been no general soaking rains in the area to give a good steady development. Much damage had been done in some places by dust storms and hot, dry winds. The crop on the whole, therefore, was backward and not likely to give good yields unless the remainder of the season were exceptionally favourable.

The season on the Station has been thoroughly bad. Fair stands of cotton were obtained early in November in spite of scanty moisture. No further good rain was received, however, until December 18th, when two inches fell in three days, and from that time there was no soaking rain until towards the end of February.

A severe dust storm on December 5th cut the crop about very badly indeed, and replantings were so much held up by drought and harried by hot winds that it was doubtful whether they would be of any use.

Rotation crops were got in well, if a little late, after the December rain, but suffered badly owing to the prolonged drought.

In the Magut district in Natal the drought has been very severe, and cattle were in such poor condition that they could not be used for cultivation. This fact, of itself, accounts for a considerable reduction of the acreage this season. Rains at the end of January brought about a remarkable improvement in the crop, however, and the plant cotton at all events is likely to give good yields.

On the Corporation's Experiment Station in this district a number of experiments had to be abandoned owing to the poor stands obtained on account of the drought, but a variety test is being carried through by means of hand watering.

Writing of the cotton-growing areas as a whole, the Principal Field Husbandry Officer of the Department of Agriculture describes 1931–32 as the worst season experienced for the past ten years. Planting conditions were unfavourable, and droughts were frequent. The low prices have, moreover, caused considerable reduction to be made in the cotton acreage. In the irrigation area on the Orange River, for example, the area this season was only 500 acres as compared with 3,400 last season.

The Department of Agriculture record with appreciation the excellent spirit of co-operation that prevails between the Corporation's officers and those of the Department.

Swaziland.

The prospects of the season 1930–31 remained doubtful, even as late as March last, when the Report was drafted. Taking the country as a whole, the close of the season did little to improve prospects already none too favourable owing to the

very late arrival of the rains and to prolonged periods of drought in the growing season.

A considerable proportion of the area could not be planted until December. A drought followed in January, and even after good rains in February, there was no reserve of moisture. Moreover, the season closed early, and the general result was that only low average yields were obtained.

The Experiment Station at Bremersdorp fared rather better than the rest of the country in both the amount of the rainfall and its distribution. The average crop on the Station, taken as a whole, was 1,000 lbs. seed cotton per acre, a most satisfactory result considering the season. There was a comparative absence of early bollworm, and high temperatures enabled the crop to ripen off before the arrival of the stainer.

Cotton Plantations Ltd., kindly placed at the disposal of the Corporation for experimental purposes a block of about 15 acres from the area irrigated by them from the Ingwavuma River. The work there last year was limited to the planting of a range of selections from U.4 and rotation crops for observation purposes. This season an experiment is being made to test the effect of different amounts of water and times of application.

The yields obtained from the irrigated plots last season, though not high, were greatly in excess of those from adjoining plots of cotton under rainfall, while some of the rotation crops were promising.

This season there has been a decided reduction in acreage, on account of the low prices, but by next year, even if the price shows no great improvement, prospects of farmers should be better, owing to the erection of a factory in Swaziland to deal with various oil seeds. By reason of the lack of a railway or

of other cheap forms of transport, it has hitherto been impossible to consider the question of the disposal of cotton seed for oil. Similarly, the cost of delivering rotation crops to consuming centres has been out of all proportion to the returns received from their sale. The existence of an oil factory operating locally, thus providing a market for oil seeds, should enable the agriculture of the country to be placed on a sounder basis.

The report on the season 1931–32, received in March, was to the effect that the cotton prospects in Swaziland were in general poor, for reasons similar to those which affected the Union of South Africa. In the main cotton-growing districts no effective rain fell until very late in the season, and owing to the low prices and the uncertainty of the planting rains, comparatively little cotton has been planted, though the amount of ratoon cotton has been increased. Owing to the prolonged drought and high winds and sand storms, the ratoon crops did not develop well, and great difficulty was experienced in establishing plant cotton. It is feared that the total production will be small and the average yields low.

Once more the Bremersdorp Experiment Station was exceptionally fortunate as regards rainfall, which, though much below normal, had been sufficient when the report was written to maintain the crop. The prospects for the season's experiments were at that time very good. An additional area of 12 acres had kindly been put at the disposal of the Corporation by Captain Lewis for the purpose of a large-scale fertiliser experiment, and on that area also the crop was doing well.

At the Low Veld Experiment Station at Ingwavuma no rain fell until late December. When the crop was planted a series of sand storms destroyed the stands, and owing to the continuance of the drought, replanting was impossible. Fortunately the work had been duplicated on the neighbouring irrigation area, where it is reported that the experiments were doing well.

At the request of the Dominions Office, Mr. Milligan was attached as Economic and Agricultural Adviser to the Mission under Sir Alan Pim appointed to enquire into the economic and financial position of Swaziland.

Southern Rhodesia.

At this time last year Major Cameron, the Corporation's Senior Officer in Southern Rhodesia, was able to report a substantial increase in the cotton acreage over that of the season 1929–30, in spite of the fact that the price can only have allowed a profit to those farmers whose yields were above the average. It would appear that many now include cotton as one of their crops, irrespective of the price, on account of its value as a rotation with maize and tobacco, while the plants are also useful for grazing purposes when the cotton season is over.

The season 1930–31 varied considerably in different parts; some districts experienced a prolonged drought in February and March, and its length largely determined the success or failure of the crop last year. On some farms, however, in Mazoe and Lomagundi districts in particular, some very good yields were obtained. The average yield per acre over the country as a whole was approximately 300 lbs. of seed cotton, which is a slight increase on the corresponding figure for last year.

The quality of the crop also showed a great improvement on that of the previous year, and the classifying, ginning, and general handling received high commendation from the Manager of the Central Cotton Exchange, Durban, as well as from the Union Government Grader. The Durban Exchange was able to sell the crop promptly at fair market values, and the Manager

adds that on receipt of the first shipment importers in Liverpool cabled repeat orders.

Last year mention was made of the severe losses from various bollworms, chiefly American bollworm, which is likely to prove one of the principal obstacles to be overcome in developing cotton-growing in Southern Rhodesia, now that the introduction of jassid-resistant strains has minimised the loss to be feared from that pest. During the season 1930–31 the loss of crop due to drought undoubtedly exceeded that caused by bollworm; nevertheless, serious loss from bollworms was experienced in some areas, and the season was notable for the severity of the attack of Sudan bollworm, relative to that of American bollworm, a contrast to the experience of previous years. It is believed, however, that, in general, Sudan bollworm causes less damage. Mr. Peat, in his report on the work of the Experiment Station at Gatooma, points out that the Sudan bollworm moves about less in feeding, the bigger bollworms feeding within the bigger bolls, instead of demolishing squares and younger bolls also. He says that one can imagine a moderately heavy and prolonged attack of Sudan bollworm which, other conditions being favourable, would still leave quite a good commercial crop to be picked, while with an attack of American bollworm of the same extent and duration, there would be no crop left at all. Taking the cotton-growing parts of the country as a whole, reports of crops very severely attacked or completely wiped out were relatively few as compared with the previous year.

Experiments on methods of control are being assiduously carried out; the measures tested include dusting with calcium arsenate and biological control through parasites. The effect of dusting seems to have been somewhat indecisive, while the parasite work is in too early a stage of development for any conclusions to be drawn at present.

Another serious pest is the cotton stainer, but trapping by means of heaps of cotton seed placed in the fields appears a promising method of control. Mr. Peat has been able to report that none of the growers whom he visited last season, who had trapped systematically, suffered serious loss from stainers. He adds that while trapping appears at present to be the only practical method of control, it will need the experience of growers over a number of years to decide whether it is an economic proposition or not.

The advice given to growers, as mentioned in last year's report, to adopt a closer spacing and not to apply fertilizers direct to the cotton crop has been justified by last season's results. The majority of growers adopted a closer spacing with beneficial results, but this practice has yet to stand the test of a really wet season, before any generalisation is possible. As regards fertilizers, experiments again failed to produce any increased yields from their direct application to the crop.

Having regard to the low price obtainable, the increase in the cotton crop from 1,481 bales in 1929–30 to nearly 2,000 bales in 1930–31, might hardly have been expected were it not, firstly, that other agricultural commodities gave, if anything, even lower cash returns, and secondly that the value of cotton as a rotation crop to maize is being increasingly recognised.

The extremely low prices at which last year's crop was sold offered little inducement to farmers to plant cotton again this season. Nevertheless the acreage planted is considerable, though less than that of last year. On the other hand it is anticipated that this year there will be a considerable increase in the acreage of ratooned cotton, with a view to reducing costs. How far this practice will prove successful remains to be seen, and there is reason to think that it would not have been adopted had prices been somewhat higher.

Until prices advance, any decided extension of cotton-growing in Southern Rhodesia is improbable, but much useful experimental work is being done in order to be in readiness for future developments. The main directions of this work are the breeding of jassid-resistant varieties of cotton of high yielding capacity and good quality that shall be suitable to local climatic conditions; methods of control of insect pests; and the determination of the cultural methods to give the best crops. Already, Major Cameron thinks enough information has been acquired to enable it to be said that cotton will add materially to the prosperity of the country when the general economic position of the world improves.

At the Cotton Breeding Station, Gatooma, a beginning was made with extension work whereby records were collected from other districts. These records were taken on farms where plots had been laid down by farmers, whose assistance in this direction is gratefully acknowledged. It is satisfactory to state that the accuracy of these records, taken by native recorders, exceeded expectations on three of the four sub-stations. Useful information regarding seasonal development, response to cultural practices, behaviour of sub-strains, and insect attack, were obtained for comparison with results obtained at Gatooma.

In February of this year Major Cameron was able to report that the cotton at Gatooma looked better than he had seen it in any previous season. He added, cautiously, that there was still time for damage to be done before the crop could be considered safe, but it was at least a month earlier than last year.

Northern Rhodesia.

Last year reference was made to the permission given to Mr. Milligan to make a tour in Northern Rhodesia at the request of the Colonial Office, in order to examine certain

problems connected with the agricultural development of the country. In his interesting report, Mr. Milligan deals with the present position of agriculture in Northern Rhodesia and the problem of the desirability of encouraging further settlement by European farmers. He points out that there is an almost total absence at present of an export market for agricultural produce, and considers that it would be wrong to encourage further settlement unless a means of disposing of the produce of the farmers is organised and assured. The Government, in expressing to the Corporation their thanks for Mr. Milligan's assistance, say that his conclusions and recommendations have been of great help in clearing up the position, and will enable them to shape their policy.

As regards cotton, owing to insect pests, the yields have hitherto been too small to give any hope that it is likely to become a profitable crop to European farmers. Its value as a rotation to maize, owing to its deep-rooting habit, is generally recognised, and it may be grown to a small extent for this purpose alone. It is feared, however, that the prospects of its eventually becoming an export crop are not at present favourable. It is thought, nevertheless, that it may have possibilities as a crop in the native areas, where labour is plentiful to destroy pests, provided that the native cultivators will do this work efficiently. The soil-renovating properties of the plant would be of considerable value as a means of supplying an alternative to the native system of shifting cultivation now practised, but the difficulty is that transport to the coast from these areas, such as the Abercorn or Fort Jameson districts, is long and costly, so that there also further development is improbable at present prices.

In climatic conditions the season 1930–31 at the Mazabuka Experiment Station was generally similar to that of 1923–24, which was the last good cotton season that Northern Rhodesia

has had. In spite, however, of the fact that the cotton now grown is U.4, which is jassid-resistant, the highest yield on the Experiment Station was 600 lbs. seed cotton per acre from one plot, while the average yield of seed cotton from 16 five-acre plots grown by farmers, was not more than 256 lbs. per acre. Losses from bollworm and stainer were very heavy, as in previous years.

In the season 1931–32 the experimental work was continued, and small plots are also being grown by selected farmers. It is not considered advisable at present, however, to issue seed for general use.

Anglo-Egyptian Sudan.

From the note supplied by the Director of Agriculture for last year's Annual Report, which was written in the middle of the picking season, it was abundantly clear that the yield of cotton in the Gezira would be unprecedently low, and this was borne out by the final figure of 1·35 kantars per feddan* over the whole cultivated area in the Gezira. Moreover, cotton prices, in common with those of all agricultural commodities throughout the world, were very low, and the quality of the cotton was unusually poor. These results combined have inevitably given a serious setback to the prosperity of the Sudan, which is so closely linked up with the success of the Gezira project. In view of the fears as to the future of that project that were expressed a year ago, it is gratifying to be able to report that the season 1931–32 has been far from providing a repetition of the experience of the two that preceded it, and a yield of 3·5 kantars per feddan† is once more in prospect in that area.

Reviewing the season 1930–31 in the Gezira, the area controlled by the Sudan Plantations Syndicate was increased to 175,418 feddans (acres), and that under the Kassala Cotton

* Approximately 128 lbs. of lint per acre.
† Do. 322 do. do.

Company to 20,605 feddans ; from the whole area, as already stated, a yield was obtained of less than 130 lbs. of lint to the acre. This result was brought about by the damage done by the two diseases known respectively as Blackarm and Leaf Curl, the serious effects of which continued up to the end of the season. Various measures were adopted to combat these diseases in the season 1931–32 :—(*a*) the rotation was changed to cotton followed by two fallows, in the hope of thereby improving the texture of the soil ; (*b*) dura was relegated to definite blocks and lubia discontinued altogether, except for a little grown for fodder ; (*c*) a fresh supply of seed was purchased from Egypt ; (*d*) this seed was chemically treated in the hope of destroying the bacterium that causes Blackarm ; and (*e*) rigorous steps were taken to remove all " volunteer " cotton plants. The removal of lubia from the rotation and the careful uprooting of " volunteer " plants from the previous cotton crop were especially directed against Leaf Curl.

The manner in which it was hoped that these measures would prove effective has been described in one of the Executive Committee's Quarterly Reports, but in view of their importance and of the greatly improved yield obtained this season, the details are repeated here. After the cotton plants have been cut down and burnt at the end of the season, sufficient vitality remains in the roots of some of them to produce new growth if moisture is available. When lubia follows cotton in the rotation, it has to be irrigated, and the mositure causes the roots of some of last season's cotton plants to sprout at the same time. It has been ascertained, firstly, that Leaf Curl is transmitted by White Fly, and secondly that these ratoon cotton shoots growing up among the lubia are nearly always infected with the virus that causes Leaf Curl. Any White Fly that have fed on these ratoon plants are thus able to infect the seedlings of the following season's cotton crop, and meanwhile they thrive and multiply by feeding on the lubia. Moreover,

these ratoon cotton plants are extremely hard to locate and eradicate on account of the cover afforded by the lubia crop. The removal of lubia from the rotation means, therefore, that the land which has carried a cotton crop will lie fallow and not be irrigated ; stray cotton roots are therefore less likely to sprout again, and should they do so under rainfall, they can be easily detected and removed. A prominent source of infection of the young seedlings should thus be eliminated.

The causes which may have contributed to two consecutive seasons of remarkably low yield in the Gezira naturally received full discussion at the annual meeting in London of the Advisory Committee for the Co-ordination of Agricultural Research in the Sudan, which was attended last year by the Governor-General. Suggestions had been made that possibly, in addition to the two diseases of Blackarm and Leaf Curl, some adverse soil factor was operating to the detriment of the plant. It is understood that this view was not that generally held by the Agricultural Department, but Mr. Bailey, Controller of Agricultural Research, consented to include in his programme for next season some experiments to test the efficacy of special methods of drainage. An extremely interesting article by Mr. R. Hewison appeared in the *Empire Cotton Growing Review* for October last ; he has arrived at the conclusion that the annual rainfall is the main determining factor of the yield of cotton in the Gezira. The probable relationship between rainfall and yield is fully discussed in the article, including the bearing of rainfall on Blackarm infection. Less is known, however, with regard to the influence of rain upon Leaf Curl, and it may be that this disease is a new factor for which special allowances will have to be made in estimating future prospects.

An important experiment has been conducted this year by Mr. Bailey with a view to settling the question whether Leaf Curl is transmitted through the seed. The result this season

has been satisfactory in giving no evidence of the possibility of such transmission. The experiment will be repeated next year in the hope of obtaining confirmatory evidence.

The Plant Breeding Section are continuing their work on breeding special types resistant to Leaf Curl, and the reports that have been received so far are to the effect that those that have been tested under Gezira conditions this year are fulfilling the hopes placed in them.

It has been said above that the results this season have been decidedly more encouraging. The crop grew extremely well, and the damage done by Blackarm and by Leaf Curl has been far less severe than in the past two years. Blackarm was very late in appearing (possibly due to a smaller degree of primary infection, owing either to the change of seed or to its chemical treatment), and its spread was slow and irregular. Nevertheless, it has certainly done serious damage, particularly in some of the best and earliest cotton, and though much further knowledge has been gained this season, it cannot be said that a method of adequate control has yet been evolved. Leaf Curl infection was far less than last year, a result which is believed to have been largely achieved through the rigorous removal of volunteer plants described above. The Agricultural Department are able to point to successful crops on all the older blocks in the Gezira, some of which have been under irrigation since 1912 : from this fact they hope that the deduction may legitimately be drawn that no serious soil deterioration is taking place.

In the season 1930–31 in the Gash Delta the area under flood irrigation was less than in the previous year, and the crop decreased from 19,716 bales to 13,624 bales of 400 lbs. On the other hand, the area flooded at Tokar was greater, giving also an increased crop of 16,221 bales as compared with 12,971 bales in 1929–30.

The output of American-type cotton, both irrigated and grown under rainfall, in 1930–31 was 25,547 bales as against 26,330 bales in the previous year. A further fall is expected this season, mainly in the amount grown under irrigation, which is likely to continue to decline while the price remains at its present level. In the rainfall area it is believed that the natives will extend cotton cultivation in the Nuba Mountains, but until prices advance, development of the crop further South in Mongalla can hardly be looked for, owing to the heavy cost of transport.

The Director of Agriculture has kindly supplied the following note, in which he gives the final output of cotton from the different districts in 1930–31, and tabulates the estimated yields for the current season at the time when his note was written (end of January).

Season 1930–31.—The following table shows the final yield of cotton from the various districts of production :—

TABLE I.

1930–31 YIELD.

SAKEL TYPE.

	Feddans.*	Yield in Kantars.†	Yield per Feddan in Kantars.
GEZIRA.			
Sudan Plantations Syndicate	175,418	227,781	1·29
Kassala Cotton Company ...	20,605	38,562	1·87
Total	196,023	266,343	1·35
TOKAR.	60,000	68,299	1·13
GASH DELTA (Kassala) ...	37,938	57,367	1·51
PRIVATE PUMPING ESTATES	2,952	6,002	2·03
Government Pump Scheme ...	550	991	1·80
Total Sakel	297,463	399,002	

Equivalent to 94,763 bales of 400 lbs.

* 1 Feddan=1·038 acres.

† 1 Kantar=312 lbs. seed cotton.

TABLE I—*continued.*

AMERICAN TYPE.

	Feddans.	Yield in Kantars.	Yield per Feddan in Kantars.
IRRIGATED.			
Government Schemes ...	5,432	17,523	3·22
Private Estates	9,793	34,033	3·47
RAIN GROWN.			
Southern Provinces.			
Kordofan (Nuba Mountains)	43,000 (Estimated)	47,827	
Upper Nile	5,333 (Estimated)	3,301	
Mongalla	7,980 (Estimated)	7,895	
Northern Provinces	4,050 (Estimated)	4,240	
Total American ...	75,588	114,819	

Equivalent to 25,547 bales of 400 lbs.

Season 1931–32.—After the unprecedentedly low yields in the Gezira in the previous season, it is most gratifying to be able to report that the present season in that area has been in every way more satisfactory, the prospects at the end of January, when this was written, being for a yield of 3 to 3½ Kantars per feddan as compared with under 1½ Kantars last year. The following table gives the estimated yields from the various districts :—

TABLE II.

ESTIMATED YIELDS OF COTTON TO BE HARVESTED IN THE SEASON 1931–32.

SAKEL TYPE.

	Feddans.	Yield in Kantars.	Yield per Feddan in Kantars.
GEZIRA.			
Sudan Plantations Syndicate	174,788		
Kassala Cotton Co.	19,191		
Total	193,979	582,000 to 679,000	3 to 3·5
TOKAR	58,000	48,200	·83
GASH DELTA (Kassala) ...	17,500	40,000	2·28
PRIVATE ESTATES	2,950	7,000	2·37
GOVERNMENT PUMPING SCHEMES	375	1,500	4·00
Total Sakel	272,804	678,700 to 775,700	

Equivalent to about 173,000 bales of 400 lbs., taking the mean of the yield estimates.

AMERICAN TYPE.

IRRIGATED.			
Government Schemes ...	3,764	12,300	3·27
Private Estates	6,989	27,600	3·94
RAIN GROWN.			
Southern Provinces.			
Kordofan (Nuba Mountains)	46,000	40,000	
Upper Nile	5,000	2,500	
Mongalla	8,840	6,500	
Northern Provinces. ...	Nil	Nil	
Total American ...	70,593	88,900	

Equivalent to 19,784 bales of 400 lbs.

It is not possible to estimate to what degree the considerable improvement in the Gezira is due to each of the various causes to which it might be in part attributed. The weather at the sowing season was favourable. Also, as mentioned above, new seed was imported from Egypt for the whole area, and was treated by a disinfectant before sowing. Sowing was carried out with great care and a very thorough search was made for ratoon cotton springing from the roots of the previous season's crop and for volunteer seedlings. These were, as far as possible, exterminated.

The crop as a whole made an excellent start, and its growth and healthy appearance was up to the standard of the best crops grown since the initiation of the scheme. Later, Blackarm appeared in many places and became generally distributed throughout the scheme, with the exception of the most northerly blocks. Its behaviour was irregular ; in some places it spread considerably, and in others it remained localised and did little damage. Taking the area as a whole, considerable loss has occurred from this cause, but very much less than in recent years. Leaf Curl appeared, but to a relatively small extent and little damage need be attributed to it this season. The most encouraging feature is the evidence afforded by this year's experience that the Gezira soil can, under suitable conditions, grow as good a cotton plant as it ever did, both on the new and the old established areas.

At Tokar the flood was a good one, and more than the average crop is anticipated. In the Gash Delta the area is reduced, partly through the adoption of a rotation in watering and partly through the depredations of locusts.

The crop of American Upland type cotton from irrigated land will show a considerable falling off, due to low prices, in

spite of an excellent yield obtained at Zeidab and on the Government Pumping Schemes in Dongola Province. The rain crop in the South will be reduced, chiefly owing to the lateness of arrival and short period of the rainy season. It is probable that the reduced prices will lead to a further diminution. In the Northern rain areas, the crop has practically disappeared for the time being.

Kenya.

With the exception of a small area of approximately 100 acres grown under irrigation by Europeans, all cotton in Kenya depends upon rainfall and is of non-European origin. The major portion of the crop is produced in North Kavirondo, in the Nyanza Province in the extreme North-West of the Colony bordering Uganda. The balance is grown in the North of the Coast Province, bordering the mouth of the Sabaki River.

The buying season in Kavirondo extends from the middle of January to mid March, and final figures of purchases are not available for a month or more after the latter date. Planting of the 1931–32 crop was late in some areas, due to the presence of locusts, which caused special attention to be given to food crops, and delayed the planting owing to the time given by natives to locust destruction. In addition, heavy rains were experienced early in December, when the early portion of the crop was ready for picking. A crop almost equal to normal is anticipated, however, and the quality of the later pickings was good.

The feature of the year is the remarkable expansion of the area under this crop in the Coast Province. Whereas the total

of the 1930–31 crop in that area was 72,000 lbs. of seed cotton, it is probable that the yield for 1931–32 will approach 600,000 lbs.

With regard to improvement in quality of lint, Kenya has been able to take advantage of supplies of seed of improved strains produced in Uganda. Government encourages production through the services of Administrative and Agricultural Officers, and the sale of seed cotton, distribution of seed and uprooting of old cotton plants is strictly controlled by legislation. The total production from the 1930–31 crop was about 800 bales of 400 lbs.

Uganda.

The note on the prospects of the season 1930–31, kindly prepared by the Director of Agriculture and incorporated in last year's Report, gave a satisfactory account of the climatic conditions up to the time of writing, and included an estimate that the crop would amount to about 180,000 bales. The weather continued favourable: in most parts hot, dry conditions caused the cotton to ripen rapidly, there was but little damage by stainers, and the crop reached a total of approximately 190,000 bales. Moreover, judging from the samples submitted for test, the Spinning Test Committee were able to report that the quality was as good as, or better than, that of any previous year, and a great improvement on that of last season.

Mention was made last year of the request made by the Government to the Corporation for assistance in providing the salaries and pension contributions of supplementary agricultural officers, who would be absorbed by the Agricultural Department as soon as circumstances permitted. Advantage was taken of

the fact that Dr. Tothill, Director of Agriculture, was in this country last summer, to confer with him on this and other matters. As a result, the Corporation agreed to contribute to the cost of two more agricultural officers for a maximum period of three years. A condition attached by the Corporation was that one of these two officers should always carry on the botanical work on cotton during the leave periods of the botanists so as to ensure that no break occurred in the direction of that work by a suitably trained man. It was also agreed that the officer selected for this purpose, Mr. J. D. Jameson, a former holder of one of the Corporation's Studentships, should be seconded to the Barberton Cotton Breeding Station immediately on his appointment to the Uganda Service. It is intended that he shall there receive instruction under Mr. Parnell for one complete season before going on to Uganda. Dr. Tothill also undertook to do his best to arrange the leaves of the botanists with a view to bringing the new scheme into action by the time that Mr. Jameson had completed his time at Barberton. The second agricultural officer appointed under this arrangement with the Corporation is Mr. W. J. M. Irving, also one of the Corporation's Students, who has been appointed to take charge of the cotton breeding work at Bukalasa during the Cotton Botanist's absence on leave this year.

The Uganda Government have recently authorised a proposal made by the Director of Agriculture for the reorganisation of the botanical work in the Protectorate, concerning which he was good enough to consult the Corporation. These proposals have as their object the consolidation of the botanical work in Uganda, and will include the abolition of the titles "Cotton Botanist" and "Assistant Cotton Botanist." Mr. Nye, the Cotton Botanist, will under the new scheme be known as the Senior Botanist, and his main duties will, as at present, relate to cotton, while, in addition, he will supervise the work

of three assistants. The duties of Mr. Hosking, now Assistant Cotton Botanist, will continue as at present to be entirely connected with cotton, except when he is acting as Senior Botanist during the absence on leave of Mr. Nye. Mr. Jameson, the conditions of whose appointment as Assistant Agricultural Officer have been described above, will act as relief botanist for Mr. Nye or Mr. Hosking when either of them is on leave. There will thus always be two fully qualified officers in the country doing botanical work connected with cotton, so that the continuity to which the Corporation attach so great importance will be assured at both Experiment Stations. The third assistant botanical officer, assisted by a Plantation Manager, will be occupied primarily with other crops, but will devote any spare time he may have to cotton, and be available for duties in connection with cotton when any of the officers mentioned above are on leave. The Director of Agriculture has been able to assure the Corporation that under the new arrangements not only will the cotton work not suffer in any way but should be improved, both in efficiency and in economy of working.

Two centres for cotton breeding have now been established in Uganda. That at Serere, in the Eastern Province, which has been in existence for some years, has been supplemented by the opening last July of the new cotton laboratory at Bukalasa in Buganda. It is hoped that this may lead to an improvement of the Buganda crop and of the cotton in the "long grass" area generally. No selection work has hitherto been done on the cotton in this part of the country, and the crop appears to have been deteriorating steadily in recent years.

At the Bukalasa Station an experiment was carried out to ascertain whether the inter-planting of cotton with other crops, which is the common practice in Buganda, has any effect on the yield of cotton. The results showed that inter-planting had

an adverse effect under the conditions of last season: that season, however, was exceptionally dry, and water deficiency may have been the biggest limiting factor in the inter-planted plots.

Last year the outstanding feature of the experimental work at Serere was the success of the strain U.4 from Barberton. During the season 1931–32, however, this success was unfortunately by no means repeated either at Serere or at Bukalasa. At Bukalasa its yield was no better than that of other varieties, while it produced a higher proportion of low grade cotton. At Serere it did better, but was not outstanding in yield, though a selection from it showed considerable resistance to the disease of Angular Leaf Spot. The quality of the lint from U.4 grown in Uganda appears also to be by no means as good as that from the same variety when grown in South Africa, and to be definitely inferior in spinning properties to the general standard of Uganda cotton.

At the end of August last, Mr. Milligan paid a short unofficial visit to Uganda, and the Government courteously gave him facilities for seeing such a proportion of the cotton-growing areas as his time allowed, as well as the experiment stations. Arising out of that visit, Mr. Milligan has suggested that the Corporation's proposal to co-operate with the Government in the establishment and maintenance of a seed farm for Buganda should receive further careful consideration. In any case, before reaching a decision as to whether a seed farm for Buganda should form an essential part of their cotton policy, the Government will doubtless await the outcome of the selection work at Bukalasa, the object of which is to determine what type of cotton is best suited to Buganda conditions, and also the results of the series of experiments now being carried out on the effect of exchange of seed between Buganda and the Eastern Province.

The segregated area in Mulondo, where seed of a selected strain is multiplied in accordance with the Government scheme described last year for seed distribution in the Eastern Province, was in the second year of its operation in the season 1930–31. The area planted was over 400 acres, as compared with 300 last year, and the average yield was 612 lbs. of seed cotton per acre.

In view of the widespread infection of the 1929–30 crop by Blackarm disease, considerable interest attaches to an article by the Government Mycologist, which appeared in the *Empire Cotton Growing Review* for January last, dealing with this disease in Uganda. In the form of Angular Leaf Spot, the disease has been common in Uganda for some years, but it was not until 1928 that it appeared in certain districts in the destructive form of Blackarm. Seed from a healthy part of the same district was substituted in the following year, but this produced no improvement. Large areas were badly attacked, and in some parts the crop was reduced to one-fifth of the normal yield. The cotton in the area supplied with healthy seed suffered as badly as any.

In view of these results, it was considered advisable to bring in fresh seed for the season 1930–31, and this was purchased from South Busoga, where Blackarm infection had been very slight in the previous season. This seed was transported to and distributed throughout the badly affected areas. In the resulting crop Angular Leaf Spot was general, and early plantings at Serere soon showed symptoms of Blackarm which spread through the crop. Fortunately, however, the climatic conditions enabled the plants to recover, and the resultant damage to the crop as a whole was almost negligible.

From the results of an experiment that was conducted to test the yields from seed obtained from areas which in the previous season were, respectively, heavily infected with

Blackarm, lightly infected, and free from the disease, it cannot be said that the seed from the areas where the infection was less severe gave a significant increase in yield. It may be noted, however, that this result was obtained in a year in which Blackarm was not serious. The conclusion drawn by the author of the article is that, under Uganda conditions, in a season in which Blackarm does not become epidemic, no advantage follows from the importation of fresh seed. Somewhat detailed reference has been made to this Uganda experience, in order to enable comparison to be made with any results of similar experiments that may be obtained elsewhere.

While on leave, the Director of Agriculture paid a visit to Lancashire, where arrangements were made for him to confer with brokers and spinners who had had experience of handling Uganda cotton. It is hoped that this interchange of views may lead to improvement in the ginning and other defects of which complaints had been made from time to time.

It is reported from Uganda that, after correspondence between the Uganda Cotton Association and the Liverpool and East India Cotton Associations, the Government have appointed a Committee to investigate and report on the present system of marketing of Uganda cotton, and the possibility of the introduction of a system of lint standards.

The Director of Agriculture has kindly furnished the following account of the season 1931–32 up to February last :—

During June and July, a large acreage was planted under favourable conditions both in the Eastern Province and in Buganda Province. During August and September weather conditions remained favourable, and at the end of September there was every prospect of a record crop.

A total of 876,012 acres were planted, compared with 738,677 acres during 1930. There was a large increase in the area under cotton in Buganda Province, some 292,000 acres being sown against 195,000 in 1930. Unfavourable weather conditions during October, and the unduly prolonged continuance of the rains during November and early December adversely affected the crop in many areas, causing heavy shedding of buds and bolls. There has been no widespread outbreak of insect damage or disease attack, though minor outbreaks of Blackarm were reported. Though it is as yet too early to give an accurate estimate of production from the 1931 plantings, it is anticipated that a crop of approximately 200,000 bales should be harvested.

Tanganyika Territory.

At the end of 1930, Mr. Stockdale, Agricultural Adviser to the Colonial Office, paid a visit to Tanganyika. In his Report he describes the policy of the Government in regard to native agriculture as being to find wherever possible an export crop suitable for each district, to encourage the cultivators to grow it, and then provide means of communication for getting the crops out. He states that in this way the productive capacity of the population has been rapidly increased. Four Agricultural Stations have been established, at three of which experiments with cotton are being conducted.

The headquarters of the Department of Agriculture were transferred three years ago from Dar es Salaam to Morogoro, and it is now proposed to overhaul the Experiment Station at the latter place and to re-organise the layout of the experimental work. Mr. Stockdale recommends that more attention should be paid to methods of field experimentation and the analysis of the results of the trials by statistical methods.

Last year, following Mr. Stockdale's visit, the Agricultural Department, through the Colonial Office, asked the Corporation to permit Mr. Milligan to pay a visit to Tanganyika, to advise on measures for improving cotton-growing in the Territory. Mr. Milligan was not able to spare time for this visit until August of last year, when he made a short tour through some of the principal cotton-growing areas, and conferred with the Governor and with the Director of Agriculture. The Governor has since referred to Mr. Milligan's visit as having been a great success, and he has expressed to the Corporation his appreciation of their action in placing Mr. Milligan's services at their disposal. Mr. Milligan's report had not been received when this Report had to be drafted.

The crop produced in 1931 amounted to only about 10,600 bales, as compared with over 23,000 bales in the previous season.

Nyasaland.

The fall in the price of cotton has naturally affected seriously the output from Nyasaland, a country from which transport costs are heavier than from most other cotton-growing parts of Africa. In August last, the former buying agreement between the Government and the British Cotton Growing Association expired, but no other buyers came forward, and the Association, therefore, once more stepped in and bought the native cotton of the 1930–31 season at prices which must again have involved a loss. That the native growers should have been disappointed with the prices that it was possible to pay was almost inevitable; in addition, perhaps, they may have felt aggrieved at the reduction in the number of markets which necessitated their produce having to be carried longer distances in some areas. The Government did all that they could by providing as much free transport and storage as

possible, and the railway reduced the rates on seed cotton in transit to the ginneries, and on lint from Blantyre and Limbe to Chiromo. Cotton was not encouraged in Northern Nyasa, and no native cotton was grown in that part.

A large amount of seed had been distributed, but the amount of cotton that was actually bought from the growers fell so far short of the estimate that it could be accounted for neither by unfavourable climatic conditions, which did not permit of a second crop, nor by the buying of first-grade cotton only, nor by the possibility that all the seed taken was not sown. The Agricultural Department conclude, therefore, that, deterred by low prices and increased distances from markets, growers did not pick, or at all events did not bring in, an appreciable proportion of the cotton that they planted.

When the question of the issue of seed for the season 1931–32 was under consideration, the British Cotton Growing Association announced that though they were unable to guarantee prices, they would provide markets similar in number to those of the previous season, and the hope was expressed that it might be possible at least to maintain the prices offered in the previous year. The Government decided that in these circumstances it could not recommend cotton-growing in the more Northerly areas, but only in the Lower Shire, in Chikwawa and in the Lisungwe district where growers particularly asked for seed. This area will be used as a reservoir for the multiplication of the U.4 variety.

It was thought probable that, with the reduced number of growers and the smaller demand for seed, it would be possible to supply nothing but U.4 seed to all districts this season. The demand for seed far exceeded expectations, however, in spite of the low prices of last year, and the lack of any guaranteed prices this season. About 200 tons of seed have been issued,

of which about three-quarters are U.4. Next season there should be plenty of U.4 to meet all requirements.

In spite of the reduction in the area in which the Government have distributed seed and of the decrease in the number of growers, it is hoped that the crop may reach about 2,500 bales, as compared with approximately 4,200 last season, if the rains are favourable in amount and distribution. The present conditions may ultimately have a beneficial effect, in that they will tend to eliminate the poor type of cultivator, while it is hoped that they will at all events enable the better farmers to keep going pending a return of better times.

The work of the Corporation's Experiment Stations has been reorganized. The Station at Port Herald has been taken over by the Government from the beginning of this year. Cotton will continue to be one of the principal crops grown, and close co-operation will be maintained with the Corporation's staff. The greater part of the cotton-breeding work has been transferred to the recently opened Station at Domira Bay, where the conditions are more favourable than at either the Makwapala or Port Herald Station.

Work at the new Station at Domira Bay has consisted chiefly in growing experimental plots and small multiplication areas of U.4 selections. It is intended also, on Dr. Harland's advice, to cross U.4 with other varieties such as Cambodia, in the hope of producing strains even better suited to local conditions.

Nigeria.

Reference was made in this Report last year to the fact that part of the Corporation's seed farm suffered somewhat severely from jassid in the season 1930–31. From about

100 acres, out of the 500 acres under cotton, very little was picked, and the average yield over the whole farm fell from 284 lbs. seed cotton per acre in 1929–30 to 220 lbs. per acre.

Owing to the apparent jassid-susceptibility at Daudawa of the strain hitherto grown for the Agricultural Department, the Department decided that this strain should not be propagated this season (1931–32). With a view to finding a more jassid-resistant strain, the Corporation agreed that informal comparative tests of other varieties should be carried out this season on their farm. Twenty-acre blocks of four new strains were accordingly planted, while, as a comparison, one block of the former strain was also grown. Each variety has been harvested and ginned separately, and observations on the growth of each variety have been made throughout the season. The remainder of the farm was planted with commercial Allen seed.

Details of the yield per acre given by the several varieties are not yet available, but the average yield from the main farm was 247 lbs. of seed cotton per acre, as compared with 220 lbs. per acre in the previous season.

It has hitherto been the practice to extend the area of the seed farm year by year with the object of reaching eventually an area of 1,000 acres under cotton, which it was calculated should suffice to supply seed for the Northern Province. Since, however, the strain that was being multiplied has proved susceptible to jassid, and further trials are consequently necessitated, the continued annual extension of the cotton acreage is no longer immediately essential to the successful working of the Agricultural Department's policy. Advantage was accordingly taken last autumn of the presence in this country of the Director of Agriculture to confer with him, and in view of the necessity for strict economy, it has been agreed that further clearing should be suspended for the present. The Director of Agriculture considers that a reduced demand for

seed from native cultivators is inevitable while prices remain so low, and the need for rapid multiplication of a selected strain is consequently no longer urgent.

There were approximately 500 acres under cotton in the season 1931–32, and no further extension is contemplated next season.

Cultivation by means of cattle is being continued; the death rate has unfortunately been high during the past year, but this is attributed by the Manager, partly to the fact that a certain number of beasts had been bought from local traders or passing Fulani graziers instead of restricting purchases to beasts bought from the Veterinary Department. The question whether a tractor should be bought to enable ploughing to be begun when the land was hard before the rains began has been fully discussed with the Manager, and it has been decided that economic use could hardly be made of one at present; its use would in any case enable no large reduction to be made in the permanent labour staff, which is needed for the planting and picking seasons.

An experiment has been made to decide whether a crop of cereals can be grown in the same land as, and immediately prior to, a cotton crop without thereby reducing the yield or quality of the latter. If successful, this would enable a reduction to be made in the area at present utilised for growing cereals only.

Mr. H. Hutchinson, the Assistant to the Manager at Daudawa, has been transferred to the Cotton Breeding Station at Barberton, and he has been succeeded by Mr. A. E. Casement.

In Nigeria as a whole, the season 1930–31 resulted in the lowest purchases of cotton for export since 1922–23. The

total amount was less than 19,000 bales, as compared with nearly 44,000 bales in the previous season. This result was undoubtedly due to the serious fall in prices, and, though there was certainly less cotton actually grown, a considerably smaller proportion of the crop than usual was sold for export.

In the Northern Provinces, as stated above, an attack of jassid was experienced for the first time. The ordinary commercial Allen cotton, the seed of which is distributed on a large scale each year, is, however, a mixture, and though some plants suffered severely from jassid, a good proportion of them seemed more resistant. Moreover, the jassid infestation was far from being universal, so that in some areas, even where seed of the same susceptible strain was distributed as had been grown on the Corporation's seed farm, the damage was not very heavy. Nevertheless, it was not thought wise by the Agricultural Department to distribute this strain again, and testing and multiplication of new strains is being carried on as rapidly as possible.

In the Southern Provinces, Ishan has apparently practically replaced native cotton for the export market : the purchases of the former variety fell from 6,000 bales to 4,200, and very little native cotton was bought at all. The botanists are endeavouring to produce a re-selection from Ishan that will be free from the roughness that has up to the present been an undesirable feature of this cotton. The Corporation are co-operating through Dr. Harland, of the Genetics Department of their Research Station, Trinidad, who is working on the production of hybrids that shall possess the required lint characters and be suited to the local climatic conditions. They have also, at the request of the Director, obtained seed of other varieties for trial in Nigeria.

As regards the season 1931–32, it is evident that at the present low price of cotton very little will be bought for export

this season. Serious as the drop in the number of bales exported undoubtedly is, it can only be hoped that, since this appears to be influenced almost entirely by the price of cotton, it will return as rapidly to at least its former level, should the price rise once more to a point at which the natives again find it a remunerative crop.

The following notes on the current season have been kindly supplied by the Director of Agriculture :

Northern Province.—It has become clear that only very small acreages of cotton were planted in Zaria and Sokoto, but in the Southern part of Katsina and in Kano Province the area was not very much less than usual. The yield per acre has been normal. There is keen competition between the several exporting firms ; but the $\frac{7}{10}$ or $\frac{8}{10}$ of a penny per pound of seed cotton, which is all that they can offer, is less than is being paid by small traders who are selling again in the most Northerly parts of Katsina and Kano where little cotton is grown, or even across the French border. Thus it is only in the most Southerly markets of Katsina that cotton is being bought in quantity for export overseas. Some 2,000 bales had been bought by mid January and the overseas export can hardly be expected to exceed 4,000 bales or so.

Southern Provinces.—There has been a marked decrease in the acreage planted with cotton as a result of last season's low prices. The amount of Ishan seed sold for planting was under one-half of the quantity sold for last season's crop. In addition, no native cotton seed has been distributed, and it is anticipated that no native cotton will be offered for sale for export. The cotton grading regulations for Ishan cotton have been made stricter, and now correspond to those which have been in force for American cotton in the Northern Provinces. The yield per acre this season seems to have been slightly below average ; but, while reduced yields are anticipated, the main factor

which will affect the amount of crop brought in will be the market price offered. It cannot be anticipated that the export of Ishan cotton will amount to more than one or two thousand bales.

Gold Coast.

In the Northern Territories selection work is being continued with a view to obtaining a type suitable to the climate in that area. Promising results have been secured with the "Ashanti" variety, which is an acclimatized American type, and with Allen obtained from Nigeria. One of the strains of the Allen variety gave a higher yield in 1930–31 than in the previous year; enough seed was available to plant five acres last season, and the strain is being tested in selected native farms. It is gratifying that this selection has maintained its yield in the present season, which has by no means favoured the crop. It is probable that from these improved strains, and with improved methods of cultivation, satisfactory yields will be obtainable, but the low price of cotton and the high cost of transport from this area constitute formidable difficulties in building up a cotton-growing industry for export at the present time.

In the trans-Volta area, as mentioned in last year's report, improved Ishan from Nigeria had shown itself to be the variety best suited to local conditions. In a 5-acre trial it gave a yield of nearly 500 lbs. of seed cotton per acre, as compared with 283 lbs. per acre obtained with the local Sonko variety. This season trials are being carried out with Ishan, both at the Experiment Station at Kpeve and on land owned by selected farmers, under the advice and superintendence of the agricultural officers. This test should show whether Ishan is suited to the conditions prevailing in the different areas.

The Department of Agriculture have been considering the question of the provision of ginning facilities in this area, and the Government are contemplating an interesting experiment for the purchase of the necessary machinery from funds subscribed by the native farmers themselves, after the formation of a co-operative society. If the preliminary steps meet with a satisfactory response, the Government will make a loan to the co-operative society, to be repaid within a stated number of years. If the scheme is successful, it should be a valuable start towards the establishment of a system for the organisation of native farmers, with a view to the provision of funds for further agricultural development.

West Indies.

In view of the continued difficulties experienced by the West Indian growers of Sea Island cotton in disposing of their produce, the Empire Marketing Board arranged for a further meeting of those interested, to be held in London in July last. The Corporation was represented by the Director, Sir James Currie. Among the conclusions reached, it was decided that it was desirable that the production should be reduced until the existing stocks, which are considerable, should be disposed of. It was also agreed that it was desirable that (*a*) a full-time specialist officer should be appointed to further the utilisation of Sea Island cotton, and (*b*) a Conference of interested parties in the West Indies should be held with a view to the foundation of a Sea Island Cotton Association. This Conference would also consider the possibility of restricting acreage and the provision from West Indian resources of the necessary funds for the appointment of the officer referred to above.

Unfortunately, in both Montserrat and Nevis, where cotton-growing is a major industry, there are at present no alternative crops, and reduction in the cotton acreage may

give rise to serious economic difficulties. In the other islands in which cotton is grown, there is either an alternative export crop, such as arrowroot in St. Vincent, or cotton is in any case of secondary importance to their principal crop.

It was reported last year that Dr. Harland had paid a visit to Montserrat in his capacity of Cotton Adviser to the Commissioner of Agriculture for the West Indies. In November last he paid another short visit to the island to see whether the seed selection work was being carried out on the lines recommended by him a year ago.

Dr. Harland was able to report that good progress had been made in the elimination of rogue cotton since his visit in the previous year. He attributes this satisfactory result to the careful inspection of seed last year, and to the work of the officers of the Agricultural Department, who followed up the seed inspection by a drastic roguing campaign. Dr. Harland has submitted recommendations for the seed supply organisation of the island, with a view to maintaining purity of strain. It is understood that this season arrangements will be possible for ginning pedigreed cotton in a building in which no other cotton seed is stored, thus removing the possibility of mechanical contamination.

In Montserrat the season 1930–31 was particularly unfavourable. Exceptionally heavy rains fell during the ripening season, and boll shedding was extremely heavy. The crop was attacked, moreover, by cotton caterpillar, and the arsenical poisons used as sprays were washed off as fast as they were applied. The yield was about 117 lbs. of lint per acre. It is satisfactory that, owing to the new seed control, a marked improvement in quality is reported. Shipments of cotton have been made this year to the United States.

Satisfactory reports have been received on the work that is being carried out at the Cotton Experiment Station, St.

Vincent, under Mr. Evelyn, whose programme of work was drawn up by Dr. Harland. It has been decided that it is impossible, without two isolated seed farms, to grow both Superfine and Ordinary Sea Island in St. Vincent, and prevent admixture. Only Superfine will accordingly be grown in future, and it is hoped that sufficient seed of two selected strains will be available to supply all that is required for the crop next season (1932–33). Promising experimental results have been obtained from Moco strains, brought from Brazil, which will be further tested for a season, after which it is hoped to distribute seed in some of the smaller neighbouring islands. Mr. Evelyn has also carried out work on a small field scale relating to some of the problems that are being investigated at the Research Station in Trinidad.

Permission was given to Mr. Evelyn last year to pay a visit, covering some two months, to the Northern Islands and to Carriacou, in the hope that the experience thus gained on cotton-growing elsewhere might be of assistance to him in his work in St. Vincent.

The season 1930–31 in St. Vincent again demonstrated the advantages derived by changing the planting date from June to October-December. Record yields were obtained on many of the Estates, while at the Experiment Station the plot of Selected Superfine gave a yield of about 500 lbs. of lint per acre. The climatic conditions at the end of the season could not have been better, and the cotton gave a better ginning out-turn than that obtained for several years. The close season has been extended to cover four months instead of two months.

In Nevis the crop of 1930–31 suffered somewhat from insect pests, but turned out much better than had been expected. A considerably smaller acreage has been planted

this season; the crop was promising at the time when this report was written, and good yields are expected. A scheme is in existence for the co-operative marketing of the cotton crop. The Government purchased the ginnery, and make advances to growers on their crops as they are delivered. This action has been of great assistance, and is reported to have been much appreciated by the cultivators.

In St. Kitts, on the other hand, the weather was against the crop, which suffered from bollworm and from stainers.

In the West Indies generally the acreage has been drastically reduced this season.

COTTON PRODUCTION FIGURES.

Island.	Lbs. of Lint.	Year.
Grenada	221,250*	1930–31
St. Vincent ...	605,280 S.I. 33,809 M.G.	1930–31
Barbados	331,123	1930–31
Montserrat ...	400,389	1931
Antigua	127,300†	1930–31
Nevis	159,102	1930–31
St. Kitts	129,894	1931
Anguilla	32,244	1930–31
Tortola	2,240	1930–31

S.I.=Sea Island. M.G.=Marie Galante.

* Of which 6,900 lbs. grown in Grenada, were probably Sea Island; balance probably all Marie Galante, though not so stated, grown in Carriacou.

† Of which 2,458 lbs. is stained cotton.

CYPRUS.

The following Note on cotton production in Cyprus in 1931 has been kindly forwarded by the Director of Agriculture :—

The area planted under cotton in 1931 was less than the area planted in 1930 and consequently a lower production is recorded.

The following table shows the area and the production for the last five years :

Year.	Acres.	Lbs. Seed Cotton.	Yield : lbs. per acre.
1927	8,176	2,813,297	344
1928	7,600	2,862,151	376
1929	7,628	4,693,511	615
1930	14,537	6,371,646	438
1931	7,695	3,789,606	492

It will be seen that the average yields per acre for 1930 and 1931 were much the same ; they were far less than that for 1929, but considerably greater than those for 1927 and 1928. This difference in yield is to a great extent the result of variation in the total area of irrigated cotton grown in any one season as compared with the area of non-irrigated cotton.

Considerable damage was again caused by bollworms, and propaganda was carried out to induce farmers to plant their cotton earlier than is the usual practice in order to obviate much of the loss and damage caused by these pests.

No fresh supplies of cotton seed were imported in 1931, but the Department of Agriculture distributed to farmers over 6 tons of seed of the " Mesowhite " variety which were produced locally from the seed imported from Iraq in 1930. This variety, which gave very satisfactory results in 1930, was, however, not so favourably reported upon as regards yield in 1931, either under irrigation or as a non-irrigated crop.

The following experimental work was carried out during the season under review :—

1. At Nicosia.—Time of sowing trials with different varieties ; trials under irrigation with " Mesowhite " variety.

2. At Livadhia.—Fertiliser trials. 3. At Karavostassi and Vatili.—Special trials with " Mesowhite " variety.

The time of sowing trials this year again demonstrated the advantages of early sowing.

Practically no rain fell during the last six months of 1931, and owing to the drought the area expected to be planted under cotton in 1932 will be considerably below the average.

Ceylon.

The inevitable effect of the serious fall in the price of cotton has caused considerable discouragement among cultivators, and the output will naturally decrease. In the dry zone where cotton is grown, the peasants badly need a money crop, and the efforts of the Agricultural Department to develop cotton-growing were meeting with moderately satisfactory results. It is to be feared, however, that the drop in prices will adversely affect what has so far been accomplished. It appears certain, in any case, that even at more profitable prices there can be little development of cotton-growing in Ceylon until it is incorporated as one crop in a properly balanced rotation. This would, however, necessitate larger holdings and the ensurance to the villagers of security of the titles of the plots they cultivate.

A further obstacle to progress is the fact that the only power gin in the island is at the spinning and weaving mills in Colombo. It is therefore necessary to send the seed cotton there from a district in which transport is expensive, and to bring the seed back again. On account of the humid atmosphere hand gins for indigenous spinning do not work so well in Ceylon as in India.

The Agricultural Department are installing a hand power gin to deal with the selected strains produced at the Experiment Station.

The amount of cotton received by the Agricultural Department in 1931 amounted to 84 bales only. There has been a slight revival of indigenous spinning, however, and the whole of the cotton grown no longer passes through the hands of the Department.

Fiji.

The past season (1930–31) was disastrous for cotton in Fiji. An estimated area of 2,250 acres was planted and fairly good stands were obtained throughout the cotton-growing parts of the island. Unfortunately, in February 1931, the whole of the cotton-growing belt was visited by a hurricane and a flood. At least 80 per cent. of the crop was destroyed by wind or flood in the Western districts, and 50 per cent. in the Sigatoka area. There is little doubt that but for this disaster the crop would have been the largest since the revival of the industry in Fiji, but instead of the 1,000 bales originally expected, it is doubtful if the output will exceed 250. The season was also particularly late on account of a number of growers having resown after the hurricane.

A short account was given in last year's Report of the plant-breeding work that has been carried out by Mr. Anson in the hope of producing a cotton suitable to the heavy rainfall conditions of Fiji, but one for which there will be a wider and steadier demand than for Sea Island, which is the only variety that has so far been exported. It was hoped that another season's work would see a definite advance in the production of a hybrid between Sea Island and a New Guinea cotton that would possess the desired characters, and might be comparable with Fine Egyptian. Unfortunately, in the hurricane and flood 51 inches of rain fell in twenty-four hours at the Experiment Station, most of the cotton plots were under several feet of water, 75 per cent. of the new selections of the Sea Island

and Kidney hybrids were lost, and the whole of the experimental work wiped out. Fortunately a sufficient number of plants of the new hybrid were saved to enable the work to be resumed, but the Station has undoubtedly been put back a year.

As regards the prospects for 1931–32, Sea Island seed will be given out to all districts, but the acreage planted will be little more than one-third that of last season. The disheartening experience of floods in two successive years, together with the low prices that can be offered, have led a number of growers to give up cotton. Mr. Anson believes that they will probably return to it again eventually and that the area will ultimately be larger than before, owing to the fact that the crop is being taken up more extensively by Fijians, whereas formerly it was grown almost entirely by Indians.

The new Sea Island × New Guinea Kidney backcross is certainly promising, especially in yield. During the season 1929–30 a yield at the rate of 3,732 lbs. per acre was obtained from a small plot of 50 plants. The average number of bolls which reached maturity on three of the best plants amounted to 641 per plant during the season 1929–30, and 814 per plant during the following season.

The Director of Agriculture has accepted a scheme put up by Mr. Anson for training Fijians in commercial agriculture. Two training centres have been selected and twenty cultivators are in training at each centre. Each centre grows cotton, a food crop, and a green manure crop, and at the end of the harvest the proceeds of the sale of the money crop are distributed among the workers. It is reported that at present the natives are most enthusiastic, and if this enthusiasm lasts, it is hoped to extend the scheme considerably.

Research.

Research Station, Trinidad.—The second Memoir of the Genetics Department has been published by the Corporation in the course of the year. It consisted of a paper by Mr. J. B. Hutchinson, which appeared in the *Journal of Genetics*, and dealt with the inheritance of corolla colour and petal size in Asiatic cottons. Further papers by Dr. Harland and by Mr. Hutchinson have been accepted for publication in the *Journal of Genetics*, and will appear later as one of the Corporation's Memoirs.

During the year advantage was taken of the presence of both Dr. Harland and Dr. Mason in this country on leave to hold meetings of the Research Station Committee, at which they gave progress reports of their Departments. Descriptions by Dr. Harland and Dr. Mason of the principal lines upon which their respective Departments have been working in the course of the past year appear below.

Dr. Mason explained to the Research Committee that his work hitherto had been mainly confined to the vegetative part of the plant ; lint and boll studies had been held up owing to insect pests. Only a limited number of plants could be grown in the present greenhouse, and further similar accommodation was required in order that physiological work on the boll might be carried out. On receiving from the Research Station Committee a report of their meeting with Dr. Mason, and their recommendation on his request for a second greenhouse, the Executive Committee decided to accede to the request, as they felt that investigations into the processes by which the cellulose in the boll is built up would be of considerable botanical interest and might also lead to results of practical value. At the suggestion of the Research Committee, Dr. Mason agreed to give precedence to work dealing with the translocation of nutrient elements and to study these processes in the bolls and the cotton hairs.

The Experiment Station which was reopened in St. Vincent two years ago has supplied Dr. Harland with facilities for carrying out experiments on a field scale, which has been impossible in Trinidad where insect pests have proved to be a limiting factor to the amount of cotton that can be grown at the Research Station.

Genetics Department.—Dr. Harland has sent the following summary of the year's work :—

New World Cottons.—Two papers have been accepted for the *Journal of Genetics* and will shortly appear. One of these records the results of crosses between the Upland type and the Crinkled Dwarf which occurs as a mutation in Sea Island cotton. Theoretically the results are of great interest, since it is shown that Crinkled behaves as a partial dominant when transferred to the Upland plant body. As a practical outcome of the work, a new type of Upland with lint 48 mm. long was bred out.

The second paper is on the inheritance and distribution of chlorophyll deficient factors in New World cottons. It is shown that there are three independently inherited factors for green. The Peruvian section comprising Sea Island, Egyptian and Ishan has one of these, while the second and third are confined to the Upland and Bourbon groups.

As a result of Dr. Harland's visit to South Africa, Rhodesia and Nyasaland, an extensive crossing programme was embarked on, involving crosses between U.4, Cambodia, Gambia Native, West Indian Native, and G. *Darwinii* (Galapagos cotton). The object of these crosses is to isolate strains with U.4 characters, but with greater resistance to jassid and adaptability to a wider range of conditions. Back-crosses of the F_1s with U.4 are being grown this season, and some are very promising Crosses of Ishan with Sea Island, with the object of imparting greater length and fineness to Ishan, have also been made.

Asiatic Cottons.—A paper by Mr. Hutchinson on the genetics of a rogue due to complementary factors will shortly appear in the *Journal of Genetics.*

The usual genetic studies are being continued.

Inter-specific Hybrids.—The possibilities of inter-specific hybrids in cotton are still being explored, and the following main advances may be mentioned: (1) the production of a partially fertile hybrid between Peruvian and Asiatic, (2) the production of a partially fertile hybrid between Sea Island cotton and the Arizona Wild Cotton (*Thurberia thespesioides*). Since Thurberia is completely immune to Blackarm, these hybrids may be of considerable commercial importance.

Cytology.—Work on the cytology of both wild and cultivated species of cotton has made great progress. Dr. Skovsted has completed a paper on the cytology of a Triploid occurring in Asiatic cotton.

Physiology Department.—Dr. Mason has supplied the following report :—

Our interest centres round two apparently interrelated problems. The first is one on which we have already done considerable work and relates to the method whereby food materials are moved from one part of the plant to another. The second deals with the conditions that determine the movement of plant food from the soil to the plant. Both phenomena are fundamental for the nutrition of seed and lint.

As sugar is the raw material from which cellulose is built, an exhaustive survey of the various types of sugar and their distribution in the plant has been carried out. Great importance attaches to the discovery of a hitherto unrecorded sugar

in the leaf. The conditions that determine the movement of sugar from the leaf have also been examined. It has been found that the fine veins have a much higher sugar concentration than the green cell, the actual seat of sugar manufacture. This movement from a region of low to one of high concentration resembles that of plant food from the soil solution into the root. In both cases energy is expended in the absorption of food materials. This analogy between the method of export of sugar from the leaf and the import of food by the root is of the first importance.

An investigation has been carried out on the ease with which the various mineral elements absorbed from the soil can move after their uptake by the plant. They can travel impartially with the transpiration stream in the wood and arrive in the leaf. Striking differences are, however, shown in their ability to move from the leaf through the bark to the boll. Nitrogen, phosphorus and potassium move readily, magnesium and sulphur with some difficulty, while calcium and chlorine are relatively immobile. This explains why in cotton seed the first three elements are present in abundance and the others are generally present in smaller amounts. It would appear, in fact, that whether or no an element moves out of the leaf depends on the hunger of the seed, etc., for that particular element.

Our attempts to elaborate a method for the diagnosis of the manurial requirements of the soil have not yet been successful. Determinations of the relative amounts of nitrogen, phosphorus and potassium to one another in the seed at present appear to be the most promising line of attack.

Experiment Stations.—In view of the difficulty experienced at some Stations in working out the results obtained during the season in time for the issue of the annual volume comprising reports from all Stations, the date for the receipt of such

reports was postponed somewhat. Nevertheless, the volume was published at the usual time in February. This was only rendered possible by a decision of the Executive Committee in accordance with which each individual Station will in future publish a full report once in three years only, while the other stations will each produce a brief summary. This alteration was made on the recommendation of the Research Station Committee, who pointed out that the annual volume was in danger of becoming somewhat unwieldy, and that in consequence readers, other than those who were engaged in similar work, might be deterred from reading accounts of the work of the Stations, which must necessarily be somewhat lengthy if they are to describe the details of the experimental work and the results obtained. Those Stations producing only summarised reports were, however, asked to take care to include any observations or results which they considered might be of immediate use to workers elsewhere.

In the volume issued this year the full reports are those from Iraq (included for the first time by the courtesy of the Iraq Government), the Sudan, Uganda, and Southern Rhodesia. As before, a preface to the volume was written by Dr. J. C. Willis, F.R.S., in which he endeavoured to describe in non-technical language the principal results that have been obtained, the main difficulties with which the Experiment Stations have had to cope, and the chief directions in which progress can be reported. Dr. Willis describes the reports on plant breeding as being again largely concerned with the success (or in rare instances non-success) of the variety U.4 and its derivatives. The chief country in which U.4 has not done well is Uganda, where it failed to repeat the high yields that it gave in the previous season, and produced lint which lacked the length and strength usually associated with Uganda cotton. Cultural methods and the trials of various rotation crops to cotton are also described in the reports together with the work on pests

and diseases with which the crop has to contend in different countries.

Home Universities and Institutions—Cambridge University. As members of the Corporation are aware, their Students in training to become specialists or agricultural officers in cotton-growing Colonies spend one year at home (usually at Cambridge) and a second year at the Imperial College of Tropical Agriculture in Trinidad. The courses at Cambridge (described in last year's Annual Report) have been so designed, in conjunction with Trinidad, as to ensure that the two years make a continuous training free from both unprofitable overlap and omission.

In July last a Conference of Directors of Agriculture was held at the Colonial Office, which was also attended by Mr. Evans, Principal of the Imperial College of Tropical Agriculture, and Professor Engledow, of the School of Agriculture, Cambridge. The opportunity was taken of inviting the Directors to discuss in detail the training desirable for the Colonial Agricultural Services, and to give their opinion of the young officers who had joined these services since the inauguration of the new scheme of training. The discussions were of great value, and there was general gratification at this opportunity—unique in Colonial agricultural history—of testing the views of the teacher, as it were, against those of the employer. It was agreed that substantially the courses at the two centres provided the training found to be desirable for the Services. Certain additions were, however, suggested. The most important of these was extra instruction in the economics of agriculture. The underlying idea was not to train greater numbers of specialists in agricultural economics, but to ensure in every agricultural officer a sound economic outlook. In agriculture, as in other industries, economic outlook must be taken to imply " business sense." Arrangements for meeting

this suggestion have already been made by both the training centres concerned.

Another addition to training facilities at Cambridge concerns plant breeding. Those who have read Dr. C. C Hurst's article on the breeding of cotton and other crops in Russia (*Empire Cotton Growing Review*, Vol. IX, No. 1, January 1932) will have realised the fundamental influence now to be expected from discoveries in cytology. This is the science of the " cells," the minute bodies of which all living things are composed. Advancing knowledge has made it possible to " create " entirely new plants. Something far more novel and important is concerned than " breeding new varieties " by artificial hybridising, for plants derived jointly from such widely differing parents as wheat and rye in one case, and the cabbage and the radish in another, have now been produced. No cotton breeder can afford to neglect this new knowledge. With help from a munificent benefaction from the Rockefeller Trust it has been possible to provide a special course on cytology in relation to breeding for any Students of the Corporation who may specialise in plant breeding at Cambridge.

Manchester University.—In the Mycology Department the work on cotton anthracnose (*Colletotrichum gossypii*) at the seedling stage of the plant was continued from the point of view of nutrition in relation to this disease. The seedlings were found to make good growth in small containers filled with sand which was watered with various mineral salt solutions. Hitherto, the positive results of the methods have been few, owing to interference by contaminating agents, such as insects and various " damping off " fungi and the failure of the plants to respond visibly to the mineral solutions so far used. It is hoped, however, that these obstacles will be overcome as the experiments progress. In addition to the above work, the

progress of the disease in the seedling has been studied under sterile conditions.

In the Entomology Department, particular attention has been paid to the effect of temperature and humidity on the life cycle of insects. Experiments to show the effect of varying temperature and humidity on the life cycle of *Thrips tabaci* were continued, and a paper containing the results of these experiments, " The Biology of Thysanoptera with reference to the Cotton Plant VII. The relation between temperature and humidity and the life cycle " appeared in the *Annals of Applied Biology*, November 1931.

The effect of humidity on the hatching of the eggs of one of the cotton stainers (*Dysdercus howardi*) was also investigated and a morphological study of the mouth-parts of this insect has been begun.

An account of the life cycle and biology of one of the jassid bugs, " The Biology of *Erythroneura pallidifrons*," has been accepted for publication by the *Bulletin of Entomological Research.*

A new greenhouse for mycological work on cotton was erected at the Experimental Grounds in 1931.

Imperial College of Science and Technology.—The botanical staff has continued its investigation of the behaviour of the fungus (*Nematospora gossypii*) which causes internal boll disease. As stated last year, this fungus shows certain peculiarities of growth, since it will not develop on a purely synthetic medium, but requires the addition of certain accessory substances which presumably it finds in the cotton plant. A survey has been made of the distribution of this accessory factor among natural products. The richest source was found to be lentils, white of egg, and unripe cotton bolls. The

substance was also found in the leaves of cotton, yeast, potato, heart muscle of the ox ; gelatine, on the other hand, was not found to contain it. The material was obtained in high concentration from lentils. Attempts to concentrate further the accessory factor led to the discovery that it consisted of two substances, the first of which has been identified and is of the nature of an alcohol. Work on the nature of the second factor is still in progress. It appears to be present in a number of purified proteins.

In the mycological department a wilt disease, of a nature somewhat similar to that of the cotton wilt, has been investigated.

The Department of Entomology's study of the most satisfactory methods of ridding seeds of insect infestation has been continued. The work consists mainly of the investigation of the effect of fumigants and in the determination, which is of equal importance, of the conditions under which penetration by the fumigant of the material to be treated can be ensured. Various fumigants have been tested.

Rothamsted Experimental Station.—Dr. Keen resumed his duties as Assistant Director on his return from India at the end of the year, and is again directing the soil cultivation studies which he initiated in the Physics Department. The rapid tests for distinguishing those saline areas which, without a dressing of gypsum or other flocculant, would become impermeable under irrigation, which have been devised by Dr. Schofield and were mentioned in last year's report, are now being extensively used by Mr. C. G. Hawes on the area commanded by the Lloyd Barrage.

The Chemistry Department under Dr. E. M. Crowther is studying the effects of the nature and amount of soil organic matter on crop growth. By far the greater part of the organic

matter occurs in a highly decomposed form as "humus," which affects the plant chiefly by its action on the physical properties of the soil. Rapid approximate analytical methods are being developed for use in surveying large areas in which, as with many cotton soils, the total organic matter contents are very low. At the same time, the much smaller fraction of the organic matter which is recent in origin, and therefore capable of influencing the soil micro-organisms and thus the supply of food to the growing plant, is being studied in relation to the effects of weather, cultivation, manuring and crop rotations. The purpose of the work is to ascertain under what conditions such organic matter liberates or locks up nitrogen compounds available to the plant and to find means of adjusting the liberation so that it occurs at the time of greatest demand by the plant. There is evidence of close analogies between some of the Sudan results and those of green manuring and other experiments at present under examination at Rothamsted and Woburn.

The Statistical Department, under Dr. R. A. Fisher, continues to help overseas experimenters in designing satisfactory field experiments and in interpreting the results. Requests for such assistance are rapidly increasing, and in many areas a marked improvement has occurred both in the proposed experiments and in the accuracy of the experimental work.

In the case of isolated workers, the assistance given by the Statistical Department often extends to the analysis of the results as well as to the provision of a suitable experimental plan for the problem put by the enquirer. In areas where the experimental work has become more advanced, the enquirer frequently deals with points on which expert statistical knowledge is essential and for which the accumulated results from previous enquiries provide an increasingly valuable aid in

formulating new schemes of work. From both aspects, therefore, there are advantages in centralisation, and, by the use of air mails, the question and the reply can be sent with the minimum delay.

In the Department of Mycology, Mr. R. H. Stoughton has continued his work on the Blackarm or Angular Leaf Spot Disease of cotton. The work is following two main lines: a study of the influence of environmental conditions on the disease, and an investigation of the parasite in pure culture. During the year the work in the control chambers has centred around the influence of air temperature and air humidity on the disease, and also the effect of alternating conditions. It has been confirmed that high air temperatures and high humidities favour infection, but that while the high air temperature requires to be maintained throughout the development of the disease, the humidity is of importance mainly during the first day or so after inoculation.

A point of practical importance in the pure culture investigations is that the organism can exist in a number of quite distinct strains or variants derivable from one another, and varying greatly in their effect on the plant, some being almost innocuous, but being capable of giving rise directly to the virulent type.

Studentships.

Five holders of the Corporation's Studentships completed their training in July 1931. Two of these received junior appointments at the Corporation's Plant Breeding Station at Barberton, in the Transvaal, as assistant agriculturists, while Mr. Pearson, an entomologist who had taken a further year's course at Harvard University, as mentioned in the Report last year, has also joined the Barberton staff. The two remaining Students of the 1930–31 group have received appointments as

supplementary agricultural officers in Uganda. The conditions of these appointments are described in this Report in the section relating to Uganda.

Of the holders of First Year Studentships in 1930–31, one who had been elected to a Studentship as an agriculturist, expressed a desire to take up entomology instead. The reports on his First Year work had been extremely satisfactory, but the Corporation regarded it as unlikely that they would need another entomologist in the near future, and they were consequently unable to renew his Studentship. They were glad, however, to be able to support his application for one of the Colonial Office Scholarships, which was successful. There are now only two holders of Studentships at the College in Trinidad, the smallest number since the full scheme was started.

In their Quarterly Report in July last, the Executive Committee announced that the number of applications for Studentships for 1931–32 had been far greater than usual: over 70 applications were received as against 40 to 45 in previous years, moreover, the majority of the candidates had rather better academic qualifications and more experience than in former years. These facts were clearly attributable to the difficulty experienced by University men at the present time in obtaining paid posts immediately after graduation. The Committee elected four new Students from among the candidates, and they are all taking the first year of their course at the School of Agriculture, Cambridge.

In their July Report, the Executive Committee wrote of the difficulty that they felt might arise in finding posts for men who have finished their Studentship course, in view of the present universal economic depression. They pointed out at that time that although the Corporation do not undertake to

provide or find posts for their Students, they do not wish to provide facilities, by means of these Studentships, for young men to enter upon an advanced and specialised course of instruction, unless there is a reasonable prospect of a career for them at the end of it. They announced, therefore, that they intended seriously to consider the question of the future of their Studentships. As a result, in December last, the Committee made known to the Colonial Office, the Universities and Agricultural Colleges their decision to suspend the Corporation's offer of Studentships for the present. The reasons for this decision have been alluded to above, and were set out fully in the Executive Committee's Report submitted to Council last January; the present Annual Report reaches a wider and somewhat different public, however, and it is therefore worth while repeating here the facts as they presented themselves to the Executive Committee.

When the Corporation instituted their scheme over ten years ago, they intended the Studentships to serve a dual purpose. Firstly, they served as a means of providing suitable advanced training for the junior officers required to build up the Corporation's own staff abroad, and secondly, they were of value in raising the standard of men who subsequently joined the Government Agricultural Departments in different cotton-growing parts of the Empire. This need for strengthening the Agricultural Departments was emphasised in the Report of the Empire Cotton Growing Committee of the Board of Trade, and it was recognised by the Corporation on their formation that work towards this end was one of their most urgent and important tasks. By means of their Studentships, the Corporation have up to the present assisted in the training of 78 men; 21 received their first appointments on the Corporation's staff, while 30 are in the Colonial Agricultural Services. In former years, therefore, any Students not required for the Corporation's staff have thus readily found similar work with

equally good prospects for their future. Now, however, the position is entirely different. In the first place, it is unlikely that any further expansion of the Corporation's staff will be needed in the immediate future. Secondly, whereas, when these Studentships were first offered, no other sources existed from which assistance towards the expenses of advanced training of this kind could be obtained, the Agricultural Scholarship Scheme of the Colonial Office has now been instituted and is in full working. This Scheme follows much the same lines as that of the Corporation's Studentships, and serves as the main source of recruitment of Colonial Agricultural Officers. Unless, therefore, the economic position in the Colonies and Protectorates improves sufficiently to render it possible for them to absorb each year rather more agricultural officers than the Colonial Agricultural Scholarships will supply, men trained with the assistance of the Corporation's Studentships might find it difficult, in the next few years at all events, to obtain employment suited to their training and in posts where they could promote cotton-growing.

In these circumstances the Corporation decided to suspend for the present their offer of Studentships. It is true that vacancies may naturally be expected to occur from time to time on the Corporation's staff, but it is most unlikely that these will be sufficiently numerous to justify the award of Studentships each year. The Corporation prefer deliberately to face the risk of there again arising a shortage of men for posts rather than that there should be a shortage of posts for men whom they have helped to train. Meanwhile, they wish it to be understood that, for such vacancies as may normally occur on their staff, these Studentships will continue to be regarded as the ordinary means of recruitment, and the offer of two or three will accordingly be renewed whenever it may be justified by the probability of vacancies.

Imperial College of Tropical Agriculture.

The Executive Committee assented to a request from the Governing Body of the College that they would associate themselves with them in a deputation to the Secretary of State for the Colonies, to urge upon him the necessity for placing the finances of the College on a stable basis. Owing to the fact that the Empire Marketing Board had been obliged to revise the terms of their grant, reducing it by 10 per cent. and making it an annual grant only instead of for a fixed term of five years, the College found itself in a position of considerable financial difficulty. The deputation, which was introduced by Lord Derby, was received by Sir Philip Cunliffe-Lister on December 10th. The Secretary of State assured the deputation that he fully appreciated the difficulties under which the College was working, and satisfied them as to his desire to secure its continued efficiency.

Manchester Grammar School.

The Corporation acceded to a request received from Manchester Grammar School to make a contribution to the cost of the experimental greenhouse to be built in connection with the School's new biological laboratories. The total cost of the greenhouse was approximately £300, and towards this sum the Corporation contributed £200. The High Master has since informed the Corporation that he has been successful in obtaining the balance from other sources.

Spinning Tests.

The number of samples submitted for examination, either by Directors of Agriculture or by members of the Corporation's staff, has been approximately on the same scale as last year. Brokers' reports have been obtained and spinning tests carried out on 125 samples during the past year.

The Corporation welcome this opportunity of again putting on record their indebtedness to the brokers who have thus placed their time and experience at the disposal of the Corporation in examining the samples, and to members of the staff of the Liverpool Cotton Association for their assistance. The thanks of the Corporation are likewise due to members of the Spinning Test Committee, who inspect all samples submitted for spinning tests, make suggestions as to the counts to which they should be spun, and examine the yarn produced, and to members of the staff of the Shirley Institute.

All samples of American-type cotton submitted for test were spun last year in the experimental workrooms of the Shirley Institute. Some samples of Egyptian-type cotton from the Sudan were spun in the Experimental Department of the Fine Cotton Spinners' and Doublers' Association, to whose Directors the Corporation wish to record their thanks for kindly extending to them these facilities.

The Director of Agriculture, Nigeria, submitted 20 samples of improved Ishan cotton, with a view more especially to their examination by the Spinning Test Committee and to the measurement of their hair characters. The Agricultural Department is anxious to remove from this cotton the roughness which it possesses, and the samples submitted were the result of preliminary selection work by the botanist in Nigeria carried out with the object of eliminating this character. The Committee placed the samples in order of merit as regards roughness, and subsequent tests at the Shirley Institute showed a definite correlation between roughness and hair weight, roughness being associated with high hair weight per centimetre. It is hoped that these results will be a guide to the Nigerian authorities as to which samples should be discarded and which should be the subject of further selection. Dr. Harland suggested that this character might be eliminated by

crossing Ishan cotton with a Montserrat Sea Island and back-crossing the progeny with Ishan several times. He also supplied some Montserrat seed, which was transmitted to Nigeria in order that the experiment might be tried.

It is very gratifying to report that the facilities for conducting spinning tests at the Shirley Institute afforded by the experimental workrooms, together with the new procedure in hair-testing, have led, as expected, to more complete control and much speedier completion of the tests. Time has been saved in hair-testing by the adoption of the " Combined Stapling Test," described last year.

It is necessary to know at least the " length " characters of a cotton in order to determine the most suitable conditions for processing in the spinning tests ; cottons of different lengths should be processed with different roller settings, etc., and it is only under the new conditions that it has been possible to make any desired adjustments to suit the particular needs of each individual sample. Although the new facilities make it possible to complete a spinning test much more speedily than formerly, the actual spinning time has been increased, as all samples are now spun to at least two counts instead of only one, as explained in last year's Report. This more extended testing is, however, undoubtedly justified by the additional information which it provides about the spinning capacity of a cotton. Note is taken of the breakages during spinning and any abnormal behaviour during the processing.

The yarn tests comprise measurements of (1) *lea strength ;* (2) number of breaks per 1,000 yards during winding under constant tension, by the " *winding test,*" which detects the presence of comparatively infrequent weak places ; (3) " work of rupture " of a lea, by the " *ballistic test* " ; and (4) the " *actual count* " of the yarn, which usually differs slightly from the " nominal " count.

The final stage is the examination of the yarns by the Spinning Test Sub-Committee, who classify the yarns and place them in order of merit according to their " appearance." It hardly appears possible to replace the visual judgment by a physical measurement of yarn appearance, as this is such a complex property, involving irregularity of diameter, neppiness, hairiness, cleanliness, and other factors. The opinion of the sub-committee on the raw cottons, and on the yarns spun from them, and on their probable commercial capabilities, are incorporated in the " general remarks " of the report. These " general remarks " are largely devoted to a comparison of the cottons of any batch with one another, but they are also compared with a commercial cotton of a standard type which the samples most nearly resemble, and which is spun at the same time as the samples in question.

While every possible care is taken to render the tests as accurate and informative as possible, those in charge of the testing are handicapped if they are not fully informed of the *object* of the tests, and of the relative agricultural merits of the samples submitted. In such circumstances, they may unwittingly fail to give all the assistance possible to the cotton breeder. Not only would the general remarks be more valuable when written with a complete understanding of the problem of the breeder, but even the individual treatment in the spinning tests might sometimes be modified with advantage in the light of the information received, with a view to obtaining additional knowledge of the spinning capacities in exceptional cases, without in any way affecting the comparative basis of the tests. In a revised form for recording the spinning test results, columns have accordingly been allotted for specific agricultural details—" yield per acre," " ginning out-turn," " type of gin," etc., when these are supplied by the sender of the samples. It would also add to the usefulness of the tests if the cotton breeder could state the latest date by which the reports should

be received by him to be of use in determining the sowing policy for the following season ; while it might not always be possible to issue the complete report in the time available, an effort would be made to supply at least a useful preliminary report if such were desired.

One of the greatest difficulties in the determination of the measurable characters is that of sampling. The hair tests are made on a small sample weighing only 15 mgms., and an elaborate investigation of sampling has recently been started in order to decide on the most satisfactory technique for obtaining a representative sample of 15 mgms. from a sample weighing an ounce or more. The cotton chosen for the test was a Tanganyika sample which there was no reason to suppose was in any way exceptional. The " observer effect " was first tested, each of four observers making four tuft-samples weighing 15 mgms. each, and then testing one of his own tufts and also one tuft prepared by each of the other observers. It was found that all the observers obtained practically the same results, so that in any given case the result should not depend upon the particular observer who makes the test.

A test was made on the variability of the sample, in order to determine how many tufts should be taken in order to give a result subject to reasonably small random errors. It was found that the variability of hair weight per centimetre was extremely great, the range for one cotton being from 89 units to 214 units for the mean hair weight measured on each of 10 separate tufts chosen at random. It has finally been decided to take 64 tufts in sampling ; this number gives quite an accurate value for the hair length, but a less accurate value for the hair weight, owing to the greater variability of this property. To reduce sampling and experimental errors still further, all tests are now done in duplicate by two independent observers, and each value given in the reports is the mean of their results.

The cotton breeder, of course, has his own sampling problems, but it is a much simpler matter to obtain a representative 7-lb. sample from a small plot than to get a good sample of 15 mgms. from an ounce of cotton. The principles are the same, however, and the cotton breeder should exercise the greatest possible care to ensure that any sample sent for a spinning test is really representative of the bulk or plot from which it is taken.

Samples tested during the year include an interesting series from the Sudan, in which immaturity was seen to be definitely associated with the locality having the smallest rainfall and light soil. Other samples tested were from Tanganyika, South Africa, Nigeria, Uganda, and Fiji (Kidney × Sea Island hybrids). The Fiji samples were remarkable for their length in conjunction with comparative coarseness, which renders them inferior in strength not only to West Indian Sea Island but to the best Sakels; there is probably a limited market for this type of cotton in the fine hosiery trade, where its whiteness should command a premium over, say, Pima, which is much browner.

Mechanical Transport.

It is thought that readers of the Corporation's Report will wish to continue to be kept in touch with the experimental work having as its object the improvement of Mechanical Transport in the Dominions and Colonies, which is directed by the Government Committee of which Sir James Currie is Chairman.

In last year's Report mention was made of the unit specially designed for economic transport on cheap roads which was in process of construction for the Committee. This unit, which will carry a load of 15 tons and is composed of an eight-wheeled tractor and two eight-wheeled trailers, has now been

completed: trials are being carried out over surfaces and gradients such as are likely to be met with in oversea conditions, and any modifications which appear to be necessary are being made from time to time. When this vehicle has completed some 5,000 miles during its trials in England, it is to be tested further under actual working conditions abroad. It is hoped that the experience gained with these vehicles can be embodied in a unit to carry considerably heavier loads over the same class of cheap roads.

Experiments and tests are being continued with caterpillar tracks, but the Committee believe that it will be possible to evolve a wheeled unit to handle a useful load of about 30 tons, thus securing a higher speed than would be economically possible if caterpillar tracks were used, and also reducing the first cost of the vehicles composing the unit.

Considerable strides have been made during the past year in the commercial construction of Diesel engines for motor transport requirements. The 15-ton unit is being tested with a petrol engine in order to minimise the number of components that are more or less experimental. The tractor has, however, been so designed that the standard petrol engine can be replaced by a Diesel engine.

A number of experiments have been carried out with large section tyres which have been proved to give increased performance over soft and sandy ground. A 30-cwt. lorry has been despatched to the Sudan, in order that the comparative performance of tyres of three different designs may be ascertained. In view of the difficulties that have been experienced in the past owing to the provision of insufficient cooling capacity for many vehicles in common use in the Tropics, this lorry has been fitted with a special radiator so designed as to be capable of being fitted to the standard vehicle with the

minimum of alteration. The results of these tests are not at present available.

The Committee are testing any new motor vehicles as they are put on the market if they seem likely to represent advances in design for oversea work. Confidential reports on these tests are circulated to oversea officers in the hope that such information may be of use to them when deciding which vehicles are likely to give the best service under their local conditions.

The publication of the Quarterly Bulletin has been continued during the year, and would appear to be meeting a very real need.

EMPIRE COTTON GROWING CORPORATION.

EMPIRE COTTON CROPS FOR THE YEARS 1921-31, EXCLUDING INDIA.

IN BALES OF 400 lbs.

The seasons are given as covering two years (*e.g.*, 1926–1927) because in the majority of the countries named planting takes place in one calendar year and picking in the next. In a few of these countries, however (*e.g.*, Tanganyika, Iraq, Cyprus, Malta and some of the West Indian Islands), the crop is harvested in the same year as that in which it is planted. In such cases the figures should be read as relating to the crop grown and harvested in the *latter* of the two years at the head of the column.

Country.	1920–21.	1921–22.	1922–23.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	1930–31.	
(1) Anglo-Egyptian Sudan	30,519	24,074	28,306	47,652	44,912	121,131	148,118	126,115	161,536	157,769	120,310	(1)
(2) Gold Coast	61	49	15	93	1,132	1,218	285	264	296	200	297	(2)
(3) Nigeria..	30,000	15,096	16,811	25,694	39,137	47,909	27,464	20,930	32,126	43,925	18,850	(3)
(4) Uganda..	81,365	48,290	88,046	128,604	196,038	180,859	131,728	138,486	204,057	129,969	191,305	(4)
(5) Kenya	500	417	1,200	1,653	2,250	2,046	1,232	1,241	1,984	1,518	800	(5)
(6) Nyasaland	4,615	5,422	4,036	6,873	7,718	4,976	2,792	4,470	6,095	9,331	4,205	(6)
(7) Northern Rhodesia ..	100	80	102	500	379	506	32	17	—	—	—	(7)
(8) Southern Rhodesia ..	—	—	—	1,650	4,907	6,803	639	90	280	1,481	1,974	(8)
(9) Tanganyika	7,327	7,175	11,434	18,793	21,724	24,280	15,966	32,954	27,785	23,136	11,322	(9)
(10) Union of South Africa and Swaziland ..	2,923	2,740	6,523	8,730	16,936	20,381	10,242	11,013	9,774	16,213	8,123	(10)
(11) West Indies	4,763	4,314	5,295	4,309	4,186	5,941	6,076	4,088	5,312	5,672	5,106	(11)
(12) Queensland	792	3,140	9,344	11,850	14,318	7,179	5,880	10,266	6,296	13,999	12,189	(12)
(13) Cyprus	2,547	1,505	2,233	3,397	3,320	4,614	2,110	2,146	3,610	4,778	2,827	(13)
(14) Malta	582	193	118	573	782	507	342	541	379	293	201	(14)
(15) Iraq	60	300	1,100	2,400	2,540	3,500	1,800	5,200	4,700	3,300	960	(15)
(16) Fiji	—	—	85	157	123	824	356	114	271	398	240	(16)
(17) Ceylon	—	—	49	324	121	261	186	202	380	248	95	(17)
	166,154	112,795	174,697	263,252	360,523	432,935	355,248	358,137	464,881	412,230	378,804	
		Percentage Decrease 32·1.	*Percentage Increase* 54·8.	*Percentage Increase* 50·6.	*Percentage Increase* 36·9.	*Percentage Increase* 20·0.	*Percentage Decrease* 17·9.	*Percentage Increase* 0·8.	*Percentage Increase* 29·8.	*Percentage Decrease* 11·3.	*Percentage Decrease* 8·1.	

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LIST OF PUBLICATIONS ISSUED TO DATE.

"Cotton Growing within the British Empire and The World's Capacity for Consuming Cotton Goods." J. W. McConnel. 1921. Price **2s.**, post free.

"Cotton Growing in Nigeria." Sir Hector Duff. Price **2s.**, post free.

"The Extension of Cotton Cultivation in Tanganyika Territory." Major Hastings Horne. 1922. Price **2s.**, post free.

* "Cotton Cultivation in Nyasaland." H. C. Sampson. 1922. Price **2s.**, post free.

"Cotton Growing in South Africa." G. F. Keatinge. 1923. Price **2s.**, post free.

* "Cotton Growing within the British Empire." L. G. Killby. 1924. Price **2s.**, post free.

"A Cotton Research Station for the British Empire." Professor J. B. Farmer and Mr. L. G. Killby. 1925. Price **2s.**, post free.

"Report on the Cotton-Growing Industry in Uganda, Kenya, and the Mwanza District of Tanganyika." Col. C. N. French. 1925. Price **1s. 3d.**, post free.

"Reports received from Experiment Stations for the Seasons 1923, 1924, and (South Africa only), 1925." Price **2s.**, post free.

"Memorandum by the Mechanical Transport Sub-Committee." Mr. G. H. Baillie, Mr. R. H. Brackenbury, Col. C. N. French. 1925. Price **2s.**, post free.

"Report on the Cotton-Growing Industry of Nigeria, 1926." Col. C. N. French. 1926. Price **2s.**, post free.

"The Principles and Practice of Yield Trials." F. L. Engledow and G. Udny Yule. 1926. Price **2s.**, post free.

"Reports received from Experiment Stations, 1925–26." Price **2s. 6d.**, post free.

"Report on Suitable Rotation Crops for Cotton." H. C. Sampson. 1927. Price **1s.**, post free.

"Cotton Growing in Southern Africa and the Rhodesias." Report on a Tour undertaken by Sir James Currie, Mr. J. S. Addison, and Mr. H. C. Jefferys. 1927. Price **2s.**, post free.

"Reports received from Experiment Stations, 1926–27." Price **2s. 6d.**, post free.

* Out of print.

[P.T.O.

LIST OF PUBLICATIONS—*continued.*

* " Reports from Turkestan Plant Breeding Station, Tashkent." 1928. Price **2s. 6d.,** post free.

" Review of the Situation in the Principal Cotton-Growing Territories of the Empire, and a Summary of the Main Activities of the Corporation since their Formation." 1928. Price **6d.,** postage extra.

" Report on Cotton Breeding and Seed Supply in Nigeria, 1928." F. L. Engledow and C. N. French. Price **2s.,** post free.

* " Memoirs of the Cotton Research Station, Trinidad." Series B. Physiology. No. 1. Studies on the Transport of Carbohydrates in the Cotton Plant. T. G. Mason and E. J. Maskell. 1928. Price **2s. 6d.,** post free.

" Reports received from Experiment Stations, 1927–28." Price **2s. 6d.,** post free.

* " Memoirs of the Cotton Research Station, Trinidad." Series A. Genetics. No. 1. The Inheritance of (i) Petal Spot, (ii) Pollen Colour, (iii) Corolla Colour. S. C. Harland. 1929. Price **2s. 6d.,** post free.

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